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TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 97-903 MARKED: Vicksburg Chem. Cell 1

ANALYSIS OF: Soil DATE COLLECTED: 5/1/97

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	23.4	ND	ENDRIN ALDEHYDE	33.5	ND
GAMMA BHC	16.8	ND	ENDOSULFAN SULFATE	23.4	ND
BETA BHC	15.4	ND	METHOXYCHLOR	57.6	ND
HEPTACHLOR	26.8	ND	DINOSEB	100	ND
DELTA BHC	16.1	ND	ENDRIN KETONE	23.5	ND
ALDRIN	22.8	ND	TOXAPHENE	50	4600.
HEPTACHLOR EPOXIDE	21.4	ND	PCB 1016	36	ND
GAMMA CHLORDANE	24.8	ND	PCB 1221	36	ND
ALPHA CHLORDANE	5.36	ND	PCB 1232	33.5	ND
TECHNICAL CHLORDANE	50	ND	PCB 1242	33.5	ND
ENDOSULFAN I	20.1	ND	PCB 1248	33.5	ND
4,4-DDE	38.9	ND	PCB 1254	33.5	ND
4,4-DDD	33.5	ND	PCB 1260	100	ND
4,4-DDT	54.3	ND	PCB 1262	100	ND
DIELDRIN	29.5	ND			
ENDRIN	26.1	ND			
ENDOSULFAN II	26.8	ND			

SURROGATES

RECOVERY (%)

TCMX	100
DCB	99

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY _____

ppb in WATER = UG/L

ppb in SOIL = UG/KG

ANALYST Jackie Key

COMMENTS: _____

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TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 97-904 MARKED: Vicksburg Chem. C-1

ANALYSIS OF: Soil DATE COLLECTED: 5/1/97

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	23.4	ND	ENDRIN ALDEHYDE	33.5	ND
GAMMA BHC	16.8	ND	ENDOSULFAN SULFATE	23.4	ND
BETA BHC	15.4	ND	METHOXYCHLOR	57.6	ND
HEPTACHLOR	26.8	ND	DINOSEB	100	37300
DELTA BHC	16.1	ND	ENDRIN KETONE	23.5	ND
ALDRIN	22.8	ND	TOXAPHENE	50	2080.
HEPTACHLOR EPOXIDE	21.4	ND	PCB 1016	36	ND
GAMMA CHLORDANE	24.8	ND	PCB 1221	36	ND
ALPHA CHLORDANE	5.36	ND	PCB 1232	33.5	ND
TECHNICAL CHLORDANE	50	ND	PCB 1242	33.5	ND
ENDOSULFAN I	20.1	ND	PCB 1248	33.5	ND
4,4-DDE	38.9	ND	PCB 1254	33.5	ND
4,4-DDD	33.5	ND	PCB 1260	100	ND
4,4-DDT	54.3	ND	PCB 1262	100	ND
DIELDRIN	29.5	ND			
ENDRIN	26.1	ND			
ENDOSULFAN II	26.8	ND			

SURROGATES RECOVERY (%)

TCMX	91
DCB	91

MQL = MINIMUM QUANTIFIABLE LEVEL
ND = NONE DETECTED ABOVE MQL
MULTIPLE MQL BY _____
ppb in WATER = UG/L
ppb in SOIL = UG/KG

ANALYST Jackie Key

COMMENTS: _____

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TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 97-905 MARKED: Vicksburg Chem. Cell 2

ANALYSIS OF: Soil DATE COLLECTED: 5/1/97

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	23.4	ND	ENDRIN ALDEHYDE	33.5	ND
GAMMA BHC	16.8	ND	ENDOSULFAN SULFATE	23.4	ND
BETA BHC	15.4	ND	METHOXYCHLOR	57.6	ND
HEPTACHLOR	26.8	ND	DINOSEB	100	ND
DELTA BHC	16.1	ND	ENDRIN KETONE	23.5	ND
ALDRIN	22.8	ND	TOXAPHENE	50	11500.
HEPTACHLOR EPOXIDE	21.4	ND	PCB 1016	36	ND
GAMMA CHLORDANE	24.8	ND	PCB 1221	36	ND
ALPHA CHLORDANE	5.36	ND	PCB 1232	33.5	ND
TECHNICAL CHLORDANE	50	ND	PCB 1242	33.5	ND
ENDOSULFAN I	20.1	ND	PCB 1248	33.5	ND
4,4-DDE	38.9	ND	PCB 1254	33.5	ND
4,4-DDD	33.5	ND	PCB 1260	100	ND
4,4-DDT	54.3	ND	PCB 1262	100	ND
DIELDRIN	29.5	ND			
ENDRIN	26.1	ND			
ENDOSULFAN II	26.8	ND			

SURROGATES RECOVERY (%)

TCMX	95
DCB	95

MQL = MINIMUM QUANTIFIABLE LEVEL
 ND = NONE DETECTED ABOVE MQL
 MULTIPLE MQL BY _____
 ppb in WATER = UG/L
 ppb in SOIL = UG/KG

ANALYST Jackie Key

COMMENTS: _____

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TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 97-906 MARKED: Vicksburg Chem. C 2

ANALYSIS OF: Soil DATE COLLECTED: 5/1/97

COMPOUNDS	ML	ppb	COMPOUNDS	ML	ppb
ALPHA BHC	23.4	ND	ENDRIN ALDEHYDE	33.5	ND
GAMMA BHC	16.8	ND	ENDOSULFAN SULFATE	23.4	ND
BETA BHC	15.4	ND	METHOXYCHLOR	57.6	ND
HEPTACHLOR	26.8	ND	DINOSEB	1000	118000
DELTA BHC	16.1	ND	ENDRIN KETONE	23.5	ND
ALDRIN	22.8	ND	TOXAPHENE	50	12900.
HEPTACHLOR EPOXIDE	21.4	ND	PCB 1016	36	ND
GAMMA CHLORDANE	24.8	ND	PCB 1221	36	ND
ALPHA CHLORDANE	5.36	ND	PCB 1232	33.5	ND
TECHNICAL CHLORDANE	50	ND	PCB 1242	33.5	ND
ENDOSULFAN I	20.1	ND	PCB 1248	33.5	ND
4,4-DDE	38.9	ND	PCB 1254	33.5	ND
4,4-DDD	33.5	ND	PCB 1260	100	ND
4,4-DDT	54.3	ND	PCB 1262	100	ND
DIELDRIN	29.5	ND			
ENDRIN	26.1	ND			
ENDOSULFAN II	26.8	ND			

SURROGATES

RECOVERY (%)

TCMX	95
DCB	97

ML = MINIMUM QUANTIFIABLE LEVEL
 ND = NONE DETECTED ABOVE ML
 MULTIPLE ML BY _____
 ppb in WATER = UG/L
 ppb in SOIL = UG/KG

ANALYST Jackie Key

COMMENTS: _____

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TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 97-907 MARKED: Vicksburg Chem. Cell 3

ANALYSIS OF: Soil DATE COLLECTED: 5/1/97

COMPOUNDS	ML	ppb	COMPOUNDS	ML	ppb
ALPHA BHC	23.4	ND	ENDRIN ALDEHYDE	33.5	ND
GAMMA BHC	16.8	ND	ENDOSULFAN SULFATE	23.4	ND
BETA BHC	15.4	ND	METHOXYCHLOR	57.6	ND
HEPTACHLOR	26.8	ND	DINOSEB	1000	ND
DELTA BHC	16.1	ND	ENDRIN KETONE	23.5	ND
ALDRIN	22.8	ND	TOXAPHENE	50	18200.
HEPTACHLOR EPOXIDE	21.4	ND	PCB 1016	36	ND
GAMMA CHLORDANE	24.8	ND	PCB 1221	36	ND
ALPHA CHLORDANE	5.36	ND	PCB 1232	33.5	ND
TECHNICAL CHLORDANE	50	ND	PCB 1242	33.5	ND
ENDOSULFAN I	20.1	ND	PCB 1248	33.5	ND
4,4-DDE	38.9	ND	PCB 1254	33.5	ND
4,4-DDD	33.5	ND	PCB 1260	100	ND
4,4-DDT	54.3	ND	PCB 1262	100	ND
DIELDRIN	29.5	ND			
ENDRIN	26.1	ND			
ENDOSULFAN II	26.8	ND			

SURROGATES

RECOVERY (%)

TCMX	94
DCB	100

ML = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE ML

MULTIPLE ML BY _____

ppb in WATER = UG/L

ppb in SOIL = UG/KG

ANALYST Jackie Key

COMMENTS: _____

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TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 97-908 MARKED: Vicksburg Chem. C3

ANALYSIS OF: Soil DATE COLLECTED: 5/1/97

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	23.4	ND	ENDRIN ALDEHYDE	33.5	ND
GAMMA BHC	16.8	ND	ENDOSULFAN SULFATE	23.4	ND
BETA BHC	15.4	ND	METHOXYCHLOR	57.6	ND
HEPTACHLOR	26.8	ND	DINOSEB	1000	824000
DELTA BHC	16.1	ND	ENDRIN KETONE	23.5	ND
ALDRIN	22.8	ND	TOXAPHENE	50	32000
HEPTACHLOR EPOXIDE	21.4	ND	PCB 1016	36	ND
GAMMA CHLORDANE	24.8	ND	PCB 1221	36	ND
ALPHA CHLORDANE	5.36	ND	PCB 1232	33.5	ND
TECHNICAL CHLORDANE	50	ND	PCB 1242	33.5	ND
ENDOSULFAN I	20.1	ND	PCB 1248	33.5	ND
4,4-DDE	38.9	ND	PCB 1254	33.5	ND
4,4-DDD	33.5	ND	PCB 1260	100	ND
4,4-DDT	54.3	ND	PCB 1262	100	ND
DIELDRIN	29.5	ND			
ENDRIN	26.1	ND			
ENDOSULFAN II	26.8	ND			

SURROGATES

RECOVERY (%)

TCMX	96
DCB	99

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY _____

ppb in WATER = UG/L

ppb in SOIL = UG/KG

ANALYST Jackie Key

COMMENTS: _____

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TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 97-909 MARKED: Vicksburg Chem. C4

ANALYSIS OF: Soil DATE COLLECTED: 5/1/97

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	23.4	ND	ENDRIN ALDEHYDE	33.5	ND
GAMMA BHC	16.8	ND	ENDOSULFAN SULFATE	23.4	ND
BETA BHC	15.4	ND	METHOXYCHLOR	57.6	ND
HEPTACHLOR	26.8	ND	DINOSEB	1000	ND
DELTA BHC	16.1	ND	ENDRIN KETONE	23.5	ND
ALDRIN	22.8	ND	TOXAPHENE	50	490
HEPTACHLOR EPOXIDE	21.4	ND	PCB 1016	36	ND
GAMMA CHLORDANE	24.8	ND	PCB 1221	36	ND
ALPHA CHLORDANE	5.36	ND	PCB 1232	33.5	ND
TECHNICAL CHLORDANE	50	ND	PCB 1242	33.5	ND
ENDOSULFAN I	20.1	ND	PCB 1248	33.5	ND
4,4-DDE	38.9	ND	PCB 1254	33.5	ND
4,4-DDD	33.5	ND	PCB 1260	100	ND
4,4-DDT	54.3	ND	PCB 1262	100	ND
DIELDRIN	29.5	ND			
ENDRIN	26.1	ND			
ENDOSULFAN II	26.8	ND			

SURROGATES RECOVERY (%)

TCMX	92
DCB	87

MQL = MINIMUM QUANTIFIABLE LEVEL
ND = NONE DETECTED ABOVE MQL
MULTIPLE MQL BY _____
ppb in WATER = UG/L
ppb in SOIL = UG/KG

ANALYST Jackie Key

COMMENTS: _____

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TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 97-910 MARKED: Vicksburg Chem. C5

ANALYSIS OF: Soil DATE COLLECTED: 5/1/97

COMPOUNDS	ML	ppb	COMPOUNDS	ML	ppb
ALPHA BHC	23.4	ND	ENDRIN ALDEHYDE	33.5	ND
GAMMA BHC	16.8	ND	ENDOSULFAN SULFATE	23.4	ND
BETA BHC	15.4	ND	METHOXYCHLOR	57.6	ND
HEPTACHLOR	26.8	ND	DINOSEB	1000	ND
DELTA BHC	16.1	ND	ENDRIN KETONE	23.5	ND
ALDRIN	22.8	ND	TOXAPHENE	50	256
HEPTACHLOR EPOXIDE	21.4	ND	PCB 1016	36	ND
GAMMA CHLORDANE	24.8	ND	PCB 1221	36	ND
ALPHA CHLORDANE	5.36	ND	PCB 1232	33.5	ND
TECHNICAL CHLORDANE	50	ND	PCB 1242	33.5	ND
ENDOSULFAN I	20.1	ND	PCB 1248	33.5	ND
4,4-DDE	38.9	ND	PCB 1254	33.5	ND
4,4-DDD	33.5	ND	PCB 1260	100	ND
4,4-DDT	54.3	ND	PCB 1262	100	ND
DIELDRIN	29.5	ND			
ENDRIN	26.1	ND			
ENDOSULFAN II	26.8	ND			

SURROGATES RECOVERY (%)

TCMX	97
DCB	92

ML = MINIMUM QUANTIFIABLE LEVEL
ND = NONE DETECTED ABOVE ML
MULTIPLE ML BY _____
ppb in WATER = UG/L
ppb in SOIL = UG/KG

ANALYST Jackie Key

COMMENTS: _____

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TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 97-911 MARKED: Vicksburg Chem. C6

ANALYSIS OF: Soil DATE COLLECTED: 5/1/97

COMPOUNDS	ML	ppb	COMPOUNDS	ML	ppb
ALPHA BHC	23.4	ND	ENDRIN ALDEHYDE	33.5	ND
GAMMA BHC	16.8	ND	ENDOSULFAN SULFATE	23.4	ND
BETA BHC	15.4	ND	METHOXYCHLOR	57.6	ND
HEPTACHLOR	26.8	ND	DINOSEB	1000	ND
DELTA BHC	16.1	ND	ENDRIN KETONE	23.5	ND
ALDRIN	22.8	ND	TOXAPHENE	50	3740
HEPTACHLOR EPOXIDE	21.4	ND	PCB 1016	36	ND
GAMMA CHLORDANE	24.8	ND	PCB 1221	36	ND
ALPHA CHLORDANE	5.36	ND	PCB 1232	33.5	ND
TECHNICAL CHLORDANE	50	ND	PCB 1242	33.5	ND
ENDOSULFAN I	20.1	ND	PCB 1248	33.5	ND
4,4-DDE	38.9	ND	PCB 1254	33.5	ND
4,4-DDD	33.5	ND	PCB 1260	100	ND
4,4-DDT	54.3	ND	PCB 1262	100	ND
DIELDRIN	29.5	ND			
ENDRIN	26.1	ND			
ENDOSULFAN II	26.8	ND			

SURROGATES

RECOVERY (%)

TCMX	99
DCB	103

ML = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE ML

MULTIPLE ML BY _____

ppb in WATER = UG/L

ppb in SOIL = UG/KG

ANALYST Jackie Key

COMMENTS: _____

Lab Bench No.: 903
Cost Code:

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chem.

County Code:**Discharge No:**

Sample Point Identification: Cell 1

Requested By: MSDEQ

Type of Sample: **Grab:** **Composite:** **Flow:**

NPDES Permit No.:

Date Requested: 5/5/97

Data To:Kevin Posey

Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition: Clear

Where Taken: Cell 1

Collected By: KP

	Type	Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	9:00
2.		Toxaphene			
3.					
4.					
5.					

III. FIELD:

Analysis

**Computer Req
Code**

Results

Analyst**Date**

pH	000400				
D.O.	000300				
Temperature	000010				
ResidualChlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: **Otis Clark**

Recorded by: Dot Lewis

Date: 5/5/97

Date Sent to State Office:

Time: 0945

6497

VI. Remarks:

D.
Peacock

Lab Bench No.

1. GENERAL INFORMATION: Facility Name Vicksburg Chen
County Code _____ NPDES Permit No. _____
Discharge No. _____ Date Requested 5/5/97
Sample Point Identification Cell 1
Requested By MSDEQ Data To R. Posey
Type of Sample: Grab () Composite (Flow) (Time) Other () _____

II. SAMPLE IDENTIFICATION:
 Environment Condition Clear
 Where Taken Cell 1 Collected By KP

	Type	Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	9:00
2.		Toxaphene			
3.					
4.					
5.					

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus ☒ RO Vehicle ☐ Other ☐
V. LABORATORY: Received By Tim Clark Date 5-05-97 Time 0945
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

903

Lab Bench No.: 904
Cost Code:

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chem.

County Code:**NPDES Permit No.:****Discharge No:**

Date Requested: 5/5/97

Sample Point Identification: C 1

Requested By: MSDEQ

Data To: Kevin Posey

Type of Sample: Grab: Composite: Flow:

Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition: Clear

Collected By: KP

Where Taken:

Type		Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	10:00
2.		Toxaphene			
3.					
4.					
5.					

III. FIELD:

Analysis

**Computer Req
Code**

Results

Analyst**Date**

pH	000400				
D.O.	000300				
Temperature	000010				
ResidualChlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Otis Clark

Date: 5/5/97

Time: 0945

Recorded by: Dot Lewis

Date Sent to State Office:

64-97

VI. Remarks:

Lab Bench No.

II. SAMPLE IDENTIFICATION:
Environment Condition Clear Collected By KP
Where Taken _____

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus () RO Vehicle () Other ()
V. LABORATORY: Received By Phil Clark Date 5-05-97 Time 0945
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

904

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

**Lab Bench No.: 905
Cost Code:**

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chem.

County Code:

Discharge No:

Sample Point Identification: Cell 2

Requested By: MSDEQ

Type of Sample: **Grab:** Composite: **Flow:**

NPDES Permit No.:

Date Requested: 5/5/97

Data To: Kevin Posey

Time: **Other:**

II. SAMPLE IDENTIFICATION:

Environment Condition: Clear

Collected By: KP

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	9:20
2.		Toxaphene			
3.					
4.					
5.					

III. FIELD:

Analysis **Computer Req** **Results** **Analyst** **Date**
Code

pH	000400				
D.O.	000300				
Temperature	000010				
ResidualChlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Otis Clark

Recorded by: Dot Lewis

Date: 5/5/97

Date Sent to State Office:

Time: 0945

6497

VI. Remarks:

Lab Bench No.

II. SAMPLE IDENTIFICATION:
 Environment Condition Clear Collected By KP
 Where Taken cell 3

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus () RO Vehicle () Other ()
V. LABORATORY: Received By John Clark Date 5-05-97 Time 094
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

905

Lab Bench No.: 906
Cost Code:

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chem.

County Code:**Discharge No:**

Sample Point Identification: C 2

Requested By: MSDEQ

Type of Sample: **Grab:** **Composite:** **Flow:**

NPDES Permit No.:

Date Requested: 5/5/97

Data To:Kevin Posey

Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition: Clear

Where Taken:

Collected By: KP

Type		Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	10:10
2.		Toxaphene			
3.					
4.					
5.					

III. FIELD:

Analysis

**Computer Req
Code**

Results

Analyst

Date _____

pH	000400				
D.O.	000300				
Temperature	000010				
ResidualChlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: **Otis Clark**

Recorded by: Dot Lewis

Date: 5/5/97

Date: 5/5/97 **Time:** 0945
Date Sent to State Office: 6-4-97

VI. Remarks:

Lab Bench No.

II. SAMPLE IDENTIFICATION:
Environment Condition Clear Collected By KP
Where Taken _____

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus () RO Vehicle () Other ()
V. LABORATORY: Received By John Clark Date 5-05-97 Time 0945
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

906

Lab Bench No.: 907
Cost Code:

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chem.

County Code:

Discharge No:

Sample Point Identification: Cell 3

Requested By: MSDEQ

Type of Sample: **Grab:** **Composite:** **Flow:**

NPDES Permit No.:

Date Requested: 5/5/97

Data To:Kevin Posey

Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition: Clear

Where Taken:

Collected By: KP

	Type	Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	10:40
2.		Toxaphene			
3.					
4.					
5.					

III. FIELD:

Analysis

**Computer Req
Code**

Results

Analyst**Date**

pH	000400				
D.O.	000300				
Temperature	000010				
ResidualChlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Otis Clark

Recorded by: Dot Lewis

Date: 5/5/97

Date Sent to State Office:**Time: 0945**

6-4-97

VI. Remarks:

Lab Bench No.

Vicksburg Chem

NPDES Permit No.

Date Requested 5/5/97

Sample Point Identification LEWIS
Requested By ASDFG

Data To K. Posem

Type of Sample: Grab () ~~Composite~~ (Flow) (Time) Other ()

Environment Condition

Collected By KF

Where Taken *C-113*

	Type	Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	10:40
2.		Toxaphene			
3.					
4.					
5.					

Analysis

<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

Bus () RD Vehicle () Other ()

V. LABORATORY: Received By John Clark Date 5-05-97 Time 0945

Recorded By

Date Sent to State Office

Time 0945

[illegible]

Remarks

*Date of Test Initiation

Lab Bench No.: 908
Cost Code:

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chem.

County Code:**Discharge No:**

Sample Point Identification: C 3

Requested By: MSDEQ

Type of Sample: **Grab:** **Composite:** **Flow:**

NPDES Permit No.:

Date Requested: 5/5/97

Data To:Kevin Posey

Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition: Clear

Where Taken:

Collected By: KP

Type		Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	10:20
2.		Toxaphene			
3.					
4.					
5.					

III. FIELD:

Analysis

**Computer Req
Code**

Results

Analyst**Date**

pH	000400				
D.O.	000300				
Temperature	000010				
ResidualChlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Otis Clark

Recorded by: Dot Lewis

Date: 5/5/97

Date Sent to State Office:**Time: 0945**

6497

VI. Remarks:

Lab Bench No.: 909
Cost Code:

Time: Other:

Where Taken:

III. FIELD:

IV. TRANSPORTATION OF SAMPLE:

Other:

Date Sent to State Office:**VI. Remarks:**

Lab Bench No.

II. SAMPLE IDENTIFICATION:
Environment Condition Clear Collected By KP

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus () RO Vehicle () Other ()
V. LABORATORY: Received By John Clark Date 5-05-97 Time 0945
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

Lab Bench No.: 910
Cost Code:

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chem.

County Code:

Discharge No:

Sample Point Identification: C 5

Requested By: MSDEQ

Type of Sample: **Grab:** Composite: **Flow:**

NPDES Permit No.:

Date Requested: 5/5/97

Data To: Kevin Posey

Time: **Other:**

II. SAMPLE IDENTIFICATION:

Environment Condition: Clear

Collected By: KP

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	10:40
2.		Toxaphene			
3.					
4.					
5.					

III. FIELD:

Analysis **Computer Req** **Results** **Analyst** **Date**
 Code

pH	000400				
D.O.	000300				
Temperature	000010				
ResidualChlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Otis Clark

Recorded by: Dot Lewis

Date: 5/5/97

Date Sent to State Office:

Time: 0945

6-4-97

VI. Remarks:

Lab Bench No.

II. SAMPLE IDENTIFICATION:

	Type	Parameters	Preservative	Date	Time
1.	5011	Toxaphene		5/1/97	10:40
2.		Dinoseb			
3.					
4.					
5.					

<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus ☒ RO Vehicle ☐ Other ☐

V. LABORATORY: Received By Chris Clark Date 5-03-97 Time 094
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

910

Lab Bench No.

II. SAMPLE IDENTIFICATION:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Dinoseb		5/1/97	10:50
2.		Toxaphene			
3.					
4.					
5.					

<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

V. LABORATORY: Received By Chris Clark Date 5-03-97 Time 094
Recorded By _____ Date Sent to State Office _____

Remarks

911

TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 96-01188

MARKED: Vicksburg Chemical Cell 1 Top

ANALYSIS OF: Soil

DATE COLLECTED: 10-16-96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	17700
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES	RECOVERY (%)
TCMX	111
DCB	122

COMMENTS:

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY 1200

ppb in WATER = UG/L

ppb in SOIL = UG/KG

Results from samples
 taken from temp. unit
 10/16/96

++++

TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 96-01189 MARKED: Vicksburg Chemical Cell 1 Middle
ANALYSIS OF: Soil DATE COLLECTED: 10/16/96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	6180
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES	RECOVERY (%)
DBC	94

ANALYST Jackie Key
MQL = MINIMUM QUANTIFIABLE LEVEL
ND = NONE DETECTED ABOVE MQL
MULTIPLE MQL BY 1200
ppb in WATER = UG/L
ppb in SOIL = UG/KG

COMMENTS: _____

++++

TARGET COMPOUND LIST ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 96-01190 MARKED: Vicksburg Chemical Cell 1 Bottom
ANALYSIS OF: Soil DATE COLLECTED: 10-16-96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	29900
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES RECOVERY (%)

DCB	94

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL
ND = NONE DETECTED ABOVE MQL
MULTIPLE MQL BY 1200
ppb in WATER = UG/L
ppb in SOIL = UG/KG

COMMENTS: _____

++++

TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 96-01191

MARKED: Vicksburg Chemical Cell 2 Top

ANALYSIS OF: Soil

DATE COLLECTED: 10-16-96

COMPOUNDS	ML	ppb	COMPOUNDS	ML	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	40900
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES

RECOVERY (%)

DCB	155
TCMX	109

ANALYST Jackie Key

ML = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE ML

MULTIPLE ML BY 1200

ppb in WATER = UG/L

ppb in SOIL = UG/KG

COMMENTS:

TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 96-01192

MARKED: Vicksburg Chemical Cell 2 Middle

ANALYSIS OF: Soil

DATE COLLECTED: 10-16-96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	7660
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES

RECOVERY (%)

TCMX	143
DCB	131

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY 1200

ppb in WATER = UG/L

ppb in SOIL = UG/KG

COMMENTS:

TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

LAB NO.: 96-01193

MARKED: Vicksburg Chemical Cell 2 Bottom

ANALYSIS OF: Soil

DATE COLLECTED: 10-16-96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	11100
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES

RECOVERY (%)

DCB	112

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY 1200

ppb in WATER = UG/L

ppb in SOIL = UG/KG

COMMENTS:

TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB BY GC/ECD

OPCL NO.: 96-01194

MARKED: Vicksburg Chemical Cell 3 Top

ANALYSIS OF: Soil

DATE COLLECTED: 10-16-96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	22600
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES

RECOVERY (%)

TCMX	105
DCB	125

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL
ND = NONE DETECTED ABOVE MQL
MULTIPLE MQL BY 1200
ppb in WATER = UG/L
ppb in SOIL = UG/KG

COMMENTS:

TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

PCL NO.: 96-01195

MARKED: Vicksburg Chemical Cell 3 Middle

ANALYSIS OF: Soil

DATE COLLECTED: 10-16-96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	25400
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES

RECOVERY (%)

DCB	126

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY 1200

ppb in WATER = UG/L

ppb in SOIL = UG/KG

COMMENTS:

TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 96-01196

MARKED: Vicksburg Chemical Cell 3 Bottom

ANALYSIS OF: Soil

DATE COLLECTED: 10-16-96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	8600
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES

RECOVERY (%)

DCB	110

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY 1200

ppb in WATER = UG/L

ppb in SOIL = UG/KG

COMMENTS:

++++

TARGET COMPOUND LIST ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 96-01197

MARKED: VICKSBURG CHEMICAL COMP. CELL 1

ANALYSIS OF: SOIL

DATE COLLECTED: 10/16/96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	6470.0
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES

RECOVERY (%)

TCMX	149

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY 670

ppb in WATER = UG/L

ppb in SOIL = UG/KG

COMMENTS: *ANALYZED FOR TOXAPHENE ONLY

++++

TARGET COMPOUND LIST ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 96-01198

MARKED: VICKSEURG CHEMICAL COMP. CELL 2

ANALYSIS OF: SOIL

DATE COLLECTED: 10/16/96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	14300.0
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES

RECOVERY (%)

TCMX	78

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY 670

ppb in WATER = UG/L

ppb in SOIL = UG/KG

COMMENTS: *ANALYZED FOR TOXAPHENE ONLY

++++

TARGET COMPOUND LIST
ORGANOCHLORINE PESTICIDES AND PCB'S BY GC/ECD

OPCL NO.: 96-01199

MARKED: VICKSBURG CHEMICAL COMP. CELL 3

ANALYSIS OF: SOIL

DATE COLLECTED: 10/16/96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035	ND	ENDRIN ALDEHYDE	0.05	ND
GAMMA BHC	0.025	ND	ENDOSULFAN SULFATE	0.035	ND
BETA BHC	0.023	ND	METHOXYCHLOR	0.086	ND
HEPTACHLOR	0.04	ND	MIREX	0.025	ND
DELTA BHC	0.024	ND	ENDRIN KETONE	0.035	ND
ALDRIN	0.034	ND	TOXAPHENE	0.86	26100.0
CHLORPYRIFOS	0.035	ND	PCB 1016	0.054	ND
HEPTACHLOR EPOXIDE	0.032	ND	PCB 1221	0.054	ND
GAMMA CHLORDANE	0.037	ND	PCB 1232	0.5	ND
ALPHA CHLORDANE	0.008	ND	PCB 1242	0.5	ND
TECHNICAL CHLORDANE	0.14	ND	PCB 1248	0.5	ND
ENDOSULFAN I	0.03	ND	PCB 1254	0.5	ND
4,4-DDE	0.058	ND	PCB 1260	0.9	ND
4,4-DDD	0.05	ND	PCB 1262	1	ND
4,4-DDT	0.081	ND	TRIFLURALIN	0.75	ND
2,4-DDE	0.05	ND	PENDAMETHALIN	0.75	ND
2,4-DDD	0.05	ND	PROFENOFOS	0.75	ND
2,4-DDT	0.05	ND			
DIELDRIN	0.044	ND			
ENDRIN	0.039	ND			
ENDOSULFAN II	0.04	ND			

SURROGATES

RECOVERY (%)

TCMX	155

ANALYST Jackie Key

MQL = MINIMUM QUANTIFIABLE LEVEL

ND = NONE DETECTED ABOVE MQL

MULTIPLE MQL BY 670

ppb in WATER = UG/L

ppb in SOIL = UG/KG

COMMENTS: *ANALYZED FOR TOXAPHENE ONLY

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
Organochlorine Pesticides and PCBS by 8081

OPCL NO. 1197
ANALYSIS OF Soil

MARKED: Vicksburg Chemical Comp. Cell 1
DATE COLLECTED: 10-16-96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035		ENDRIN ALDEHYDE	0.05	
GAMMA BHC	0.025		ENDOSULFAN SULFATE	0.035	
BETA BHC	0.023		METHOXYCHLOR	0.086	
HEPTACHLOR	0.04		MIREX	0.025	
DELTA BHC	0.024		ENDRIN KETONE	0.035	
ALDRIN	0.034		TOXAPHENE	0.86	6770.
CHLORPYRIFOS	0.035		PCB 1016	0.054	
HEPTACHLOR EPOXIDE	0.032		PCB 1221	0.054	
GAMMA CHLORDANE	0.037		PCB 1232	0.5	
ALPHA CHLORDANE	0.008		PCB 1242	0.5	
TECHNICAL CHLORDANE	0.14		PCB 1248	0.5	
ENDOSULFAN I	0.03		PCB 1254	0.5	
4,4-DDE	0.058		PCB 1260	0.9	
4,4-DDD	0.05		PCB 1262	1	
4,4-DDT	0.081		TRIFLURALIN	0.75	
2,4-DDE	0.05		PENDAMETHALIN	0.75	
2,4-DDD	0.05		PROFENOFOS	0.75	
2,4-DDT	0.05		HEXACHLOROBENZENE	1	
DIELDRIN	0.044		GUTHION	25	
ENDRIN	0.039		cis-PERMETHRIN	10	
ENDOSULFAN II	0.04		trans-PERMETHRIN	10	

SURROGATES RECOVERY (%)
TCMX 149

MQL = MINIMUM QUANTIFIABLE LEVEL
ND = NONE DETECTED ABOVE MQL
MULTIPLY MQL BY 670
ppb IN WATER = UG/L
ppb IN SOIL = UG/KG

ANALYST Julie King

COMMENTS:

* Analyzed for TOXAPHENE only

~~X~~ Analyzed for Toxaphene only

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
Organochlorine Pesticides and PCBS by 8081

OPCL NO. 1198 MARKED: Vicksburg Chemical Comp. Cell
ANALYSIS OF Soil DATE COLLECTED: 10-16-96

COMPOUNDS	MQL	ppb	COMPOUNDS	MQL	ppb
ALPHA BHC	0.035		ENDRIN ALDEHYDE	0.05	
GAMMA BHC	0.025		ENDOSULFAN SULFATE	0.035	
BETA BHC	0.023		METHOXYCHLOR	0.086	
HEPTACHLOR	0.04		MIREX	0.025	
DELTA BHC	0.024		ENDRIN KETONE	0.035	
ALDRIN	0.034		TOXAPHENE	0.86	14300
CHLORPYRIFOS	0.035		PCB 1016	0.054	
HEPTACHLOR EPOXIDE	0.032		PCB 1221	0.054	
GAMMA CHLORDANE	0.037		PCB 1232	0.5	
ALPHA CHLORDANE	0.008		PCB 1242	0.5	
TECHNICAL CHLORDANE	0.14		PCB 1248	0.5	
ENDOSULFAN I	0.03		PCB 1254	0.5	
4,4-DDE	0.058		PCB 1260	0.9	
4,4-DDD	0.05		PCB 1262	1	
4,4-DDT	0.081		TRIFLURALIN	0.75	
2,4-DDE	0.05		PENDAMETHALIN	0.75	
2,4-DDD	0.05		PROFENOFOS	0.75	
2,4-DDT	0.05		HEXACHLOROBENZENE	1	
DIELDRIN	0.044		GUTHION	25	
ENDRIN	0.039		cis-PERMETHRIN	10	
ENDOSULFAN II	0.04		trans-PERMETHRIN	10	

SURROGATES RECOVERY (%) MQL = MINIMUM QUANTIFIABLE LEVEL
TCMX 78 ND = NONE DETECTED ABOVE MQL
 MULTIPLY MQL BY 670
 ppb IN WATER = UG/L
 ppb IN SOIL = UG/KG

ANALYST [Signature]

COMMENTS:

* Analyzed for toxaphene only

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

Lab Bench No.: 96-01197
Cost Code:

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

Discharge No:

Sample Point Identification: Composite cell 1

Requested By:

Type of Sample: **Grab:** **Composite:** **Flow:** **Time:** **Other:**

NPDES Permit No.:

Date Requested: 10/16/96

Data To: Kevin Posey

II. SAMPLE IDENTIFICATION:

Environment Condition:

Where Taken:

Collected By: K. Posey

	Type	Parameters	Preservative	Date	Time
1.	Soil	Toxaphene	Ice	10/16/96	1124
2.					
3.					
4.					
5.					

III. FIELD:

Analysis **Computer Req** **Results** **Analyst** **Date**
 Code

pH	000400				
D.O.	000300				
Temperature	000010				
Residual Chlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Recorded by: Dot Lewis

Date: 10/1/96

Date Sent to State Office:

Time: 1530

12/2/96

VI. Remarks:

Placock

Lab Bench No.

II. SAMPLE IDENTIFICATION:
Environment Condition _____ Collected By KEVIN POSEY
Where Taken _____

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

[illegible]

1197

Lab Bench No.: 96-01198
Cost Code:

Data To: Kevin Posey

CollectedBy:K. Posey

VI. Remarks:

Lab Bench No.

II. SAMPLE IDENTIFICATION:
Environment Condition _____ Collected By KEVIN POSEY
Where Taken _____

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus () RO Vehicle () Other ()
V. LABORATORY: Received By Kathy Farris Date 10-16-96 Time 1530
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

1198

Lab Bench No.: 96-01199
Cost Code:

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:**NPDES Permit No.:****Discharge No:**

Date Requested: 10/16/96

Sample Point Identification: Composite cell 3

Requested By:

Data To: Kevin Posey

Type of Sample: Grab: Composite: Flow: Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy:K. Posey

Where Taken:

Type		Parameters	Preservative	Date	Time
1.	Soil	Toxaphene	Ice	10/16/96	1132
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400				
D.O.	000300				
Temperature	000010				
ResidualChlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/1/96

Time:1530

Recorded by: Dot Lewis

Date Sent to State Office:

12/2/96

VI. Remarks:

Lab Bench No.

II. SAMPLE IDENTIFICATION:
Environment Condition _____ Collected By KEVIN POSEY
Where Taken _____

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus ☒ RA Vehicle ☐ Other ☐
V. LABORATORY: Received By Kathy Farris Date 10-16-96 Time 1530
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

1199

BUREAU OF POLLUTION CONTROL SAMPLE REQUEST FORM

Cost Code: 3800

I. GENERAL INFORMATION:

County Code:

Date Requested: 10/16/96

Sample Point Identification: Cell 1 Top

Data To: Kevin Posey

Type of Sample: Grab: X Composite: Flow: Time: Other:

II. SAMPLE IDENTIFICATION:

CollectedBy: Kevin Posey

Where Taken:

Type	Parameters	Preservative	Date	Time
1. Soil	Pesticides/Herbicides	Ice	10/16/96	1130
2.				
3.				
4.				
5.				

III. FIELD:

**Computer Req
Code****Analyst****Date**

pH	000400				
D.O.	000300				
Temperature	000010				
ResidualChlorine	050060				
Flow	074060				

IV. TRANSPORTATION OF SAMPLE:**RO Vehicle:**

Other:

V. LABORATORY:

Date: 10/16/96

Time:1530

Date Sent to State Office: 12/10/96

VI. Remarks: See attached sheet.

Lab Bench No.

II. SAMPLE IDENTIFICATION:
 Environment Condition _____ Collected By KEVIN POSEY
 Where Taken _____

IV. TRANSPORTATION OF SAMPLE: Bus () RO Vehicle () Other ()
V. LABORATORY: Received By Kathy Farris Date 10-16-96 Time 1530
Recorded By _____ Date Sent to State Office _____

Remarks

1800

1188

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

**Lab Bench No.: 96-01189
Cost Code: 3800**

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 1 Middle

Requested By:

Data To: Kevin Posey

Type of Sample: **Grab: X** **Composite:** **Flow:** **Time:** **Other:**

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Herbicides/Pesticides	Ice	10/16/96	1130
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office:

12/10/96

VI. Remarks: See attached sheet.

SAMPLE REQUEST FORM

Lab Bench No.

I. GENERAL INFORMATION: Facility Name VICKSBURG CHEMICAL
County Code _____ NPDES Permit No. _____
Discharge No. _____ Date Requested 10/16/96
Sample Point Identification CELL 1 MIDDLE
Requested By _____ Data To KEVIN POSEY
Type of Sample: Grab (☒) Composite (Flow) (Time) Other () _____

II. SAMPLE IDENTIFICATION:
Environment Condition _____ Collected By KEVIN POSEY
Where Taken _____

	Type	Parameters	Preservative	Date	Time
1.	SOIL	HERBICIDES/PESTICIDES	ICE	10/16/96	11:30
2.					
3.					
4.					
5.					

<u>III. FIELD:</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
<u>Analysis</u>	(000400)	()	_____	_____	_____
pH	(000300)	()	_____	_____	_____
D.O.	(000010)	()	_____	_____	_____
Temperature	(050060)	()	_____	_____	_____
Residual Chlorine	(074060)	()	_____	_____	_____
Flow					

IV. TRANSPORTATION OF SAMPLE: Bus (☒) RO Vehicle () Other ()

V. LABORATORY: Received By Kathy Farrow Date 10-16-96 Time 1530
Recorded By [Signature] Date Sent to State Office 12-10-96

[illegible]

Remarks

*Date of Test Initiation

1189

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

**Lab Bench No.: 96-01190
Cost Code: 3800**

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 1 Bottom

Requested By:

Data To: Kevin Posey

Type of Sample: **Grab: X** **Composite:** **Flow:** **Time:** **Other:**

II. SAMPLE IDENTIFICATION:

Environment Condition:

Collected By: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Pesticides/Herbicides	Ice	10/16/96	1130
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office:

12/16/96

VI. Remarks: See attached sheet.

Lab Bench No.

II. SAMPLE IDENTIFICATION:
Environment Condition _____ Collected By KEVIN POSEY
Where Taken _____

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus () RO Vehicle () Other ()
V. LABORATORY: Received By Kathy Farris Date 10-16-96 Time 1536
Recorded By D. Lewis Date Sent to State Office 12-10-96
Computer _____ Date _____

[illegible]

Remarks

*Date of Test Initiation

1190

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

Lab Bench No.: 96-01191

Cost Code: 3800

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 2 Top

Requested By:

Data To: Kevin Posey

Type of Sample: Grab: X Composite: Flow: Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Pesticides/Herbicides	Ice	10/16/96	1053
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office: 12/10/96

VI. Remarks: See attached sheet.

Lab Bench No.

II. SAMPLE IDENTIFICATION:
Environment Condition _____ Collected By KEVIN POSEY
Where Taken _____

III. FIELD:					
<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus () RO Vehicle () Other ()
V. LABORATORY: Received By Kathy Farris Date 10-16-96 Time 1530
Recorded By Mo/Allen Date Sent to State Office 12-10-96
Computer _____ Date _____

[illegible]

Remarks

*Date of Test Initiation

119/

Lab Bench No.: 96-01192
Cost Code: 3800

VI. Remarks: See attached sheet.

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

**Lab Bench No.: 96-01192
Cost Code: 3800**

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 2 Middle

Requested By:

Data To: Kevin Posey

Type of Sample: **Grab:** X **Composite:** **Flow:** **Time:** **Other:**

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Pesticides/Herbicides	Ice	10/16/96	1053
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office: 12/5/96

VI. Remarks: See attached sheet.

Lab Bench No.

II. SAMPLE IDENTIFICATION:

	Type	Parameters	Preservative	Date	Time
1.	SOIL	PESTICIDES/HERBICIDES	TCE	10/16/96	10:53
2.					
3.					
4.					
5.					

<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus ☐ RO Vehicle ☐ Other ☐

V. LABORATORY: Received By Kathy Farris Date 10-16-96 Time 1530
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

1192

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

Lab Bench No.: 96-01193
Cost Code: 3800

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 2 Bottom

Requested By:

Data To: Kevin Posey

Type of Sample: Grab: X Composite: Flow: Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Pesticides/Herbicides	Ice	10/16/96	1053
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office: 12/5/96

VI. Remarks: See attached sheet.

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

**Lab Bench No.: 96-01193
Cost Code: 3800**

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 2 Bottom

Requested By:

Data To: Kevin Posey

Type of Sample: **Grab: X** **Composite:** **Flow:** **Time:** **Other:**

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Pesticides/Herbicides	Ice	10/16/96	1053
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office: 12/5/96

VI. Remarks: See attached sheet.

SAMPLE REQUEST FORM

Lab Bench No.

I. GENERAL INFORMATION: Facility Name VICKSBURG CHEMICAL
County Code _____ NPDES Permit No. _____
Discharge No. _____ Date Requested 10/16/96
Sample Point Identification CELL 2 BOTTOM
Requested By _____ Data To KEVIN POSEY
Type of Sample: Grab (☒) Composite (Flow) (Time) Other () _____

II. SAMPLE IDENTIFICATION:
Environment Condition _____ Collected By KEVIN POSEY
Where Taken _____

	Type	Parameters	Preservative	Date	Time
1.	SOIL	PESTICIDES/HERBICIDES	ICE	10/16/96	10:53
2.					
3.					
4.					
5.					

III. FIELD:	Computer Code	Request	Results	Analyst	Date
Analysis					
pH	(000400)	()			
D.O.	(000300)	()			
Temperature	(000010)	()			
Residual Chlorine	(050060)	()			
Flow	(074060)	()			

IV. TRANSPORTATION OF SAMPLE: Bus () RO Vehicle () Other ()
V. LABORATORY: Received By Kathy Farris Date 10-16-96 Time 1530
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

1193

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

Lab Bench No.: 96-01194
Cost Code: 3800

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 3 Top

Requested By:

Data To: Kevin Posey

Type of Sample: Grab: X Composite: Flow: Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Pesticides/Herbicides	Ice	10/16/96	1111
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office: 12/5/96

VI. Remarks: See attached sheet.

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

Lab Bench No.: 96-01194

Cost Code: 3800

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 3 Top

Requested By:

Data To: Kevin Posey

Type of Sample: Grab: X Composite: Flow: Time: Other:

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Pesticides/Herbicides	Ice	10/16/96	1111
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office: 12/5/96

VI. Remarks: See attached sheet.

Lab Bench No.

1194

Lab Bench No.: 96-01195
Cost Code: 3800

VI. Remarks: See attached sheet.

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

**Lab Bench No.: 96-01195
Cost Code: 3800**

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 3 Middle

Requested By:

Data To: Kevin Posey

Type of Sample: **Grab:** X **Composite:** **Flow:** **Time:** **Other:**

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Herbicides/Pesticides	Ice	10/16/96	1112
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office: 12/5/96

VI. Remarks: See attached sheet.

SAMPLE REQUEST FORM

Lab Bench No.

I. GENERAL INFORMATION: Facility Name VICKSBURG CHEMICAL
County Code _____ NPDES Permit No. _____
Discharge No. _____ Date Requested 10/16/96
Sample Point Identification CELL 3 MIDDLE
Requested By _____ Data To KEVIN POSEY
Type of Sample: Grab (☒) Composite (Flow) (Time) Other () _____

II. SAMPLE IDENTIFICATION:

Environment Condition _____ Collected By KEYIN POSEY
Where Taken _____

	Type	Parameters	Preservative	Date	Time
1.	SOIL	HERBICIDES/PESTICIDES	ICE	10/16/96	11:12
2.					
3.					
4.					
5.					

III. FIELD:

<u>Analysis</u>	<u>Computer Code</u>	<u>Request</u>	<u>Results</u>	<u>Analyst</u>	<u>Date</u>
pH	(000400)	()	_____	_____	_____
D.O.	(000300)	()	_____	_____	_____
Temperature	(000010)	()	_____	_____	_____
Residual Chlorine	(050060)	()	_____	_____	_____
Flow	(074060)	()	_____	_____	_____

IV. TRANSPORTATION OF SAMPLE: Bus ☒ ~~RG Vehicle~~ ☐ Other ☐

V. LABORATORY: Received By Kathy Farris Date 10-16-96 Time 1530
Recorded By _____ Date Sent to State Office _____

[illegible]

Remarks

*Date of Test Initiation

1195

Lab Bench No.: 96-01196
Cost Code: 3800

VI. Remarks: See attached sheet.

**BUREAU OF POLLUTION CONTROL
SAMPLE REQUEST FORM**

Lab Bench No.: 96-01196

Cost Code: 3800

I. GENERAL INFORMATION:

Facility Name: Vicksburg Chemical

County Code:

NPDES Permit No.:

Discharge No:

Date Requested: 10/16/96

Sample Point Identification: Cell 3 Bottom

Requested By:

Data To: Kevin Posey

Type of Sample: **Grab: X** **Composite:** **Flow:** **Time:** **Other:**

II. SAMPLE IDENTIFICATION:

Environment Condition:

CollectedBy: Kevin Posey

Where Taken:

	Type	Parameters	Preservative	Date	Time
1.	Soil	Herbicides/Pesticides	Ice	10/16/96	1112
2.					
3.					
4.					
5.					

III. FIELD:

Analysis	Computer Req Code	Results	Analyst	Date
----------	----------------------	---------	---------	------

pH	000400			
D.O.	000300			
Temperature	000010			
ResidualChlorine	050060			
Flow	074060			

IV. TRANSPORTATION OF SAMPLE:

Bus:

RO Vehicle:

Other:

V. LABORATORY:

Received by: Kathy Farris

Date: 10/16/96

Time: 1530

Recorded by: Dot Lewis

Date Sent to State Office: 12/5/96

VI. Remarks: See attached sheet.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

4WD-RCRA

AUG 15 1996

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Steven T. Boswell
Director of Environmental Affairs
Vicksburg Chemical Company
Post Office Box 821003
Vicksburg, Mississippi 39182

SUBJ: Public Notice of EPA Intent to Approve
Extension for Temporary Unit, Pursuant to
Subpart S of 40 CFR Part 264, Submitted by
Vicksburg Chemical Company, MSD 990 714 081,
to Complete Evaluation of Bioremediation for
Corrective Action Required under Consent Decree,
Civil Number W92-0008(B)

Dear Mr. Boswell:

The U.S. Environmental Protection Agency (EPA), Region 4, has completed a review of the request for the extension referenced above. EPA intends to approve the extension, which Vicksburg Chemical Company (VCC) requested verbally, and by letter, dated August 2, 1996. Enclosed please find a public notice of EPA's intent to approve the extension for the temporary unit at the VCC site on Rifle Range Road, Vicksburg, Mississippi.

Please arrange for this public notice to be published in the *Vicksburg Evening Post* on August 19, 1996, for a public review and comment period from August 20, 1996 to October 20, 1996. In addition, please arrange for the following:

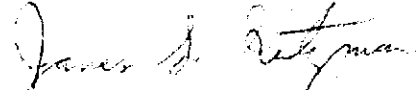
1. Public review of the application and all relevant documents at the Warren County Library, 700 Veto Street, Vicksburg, Mississippi 39180; Phone: (601) 636-6411; and
2. A public meeting at the Warren County Library, on Tuesday evening, September 24, 1996, beginning at 5:45 PM and ending at 7:45 PM, Central Daylight Time.

EPA will also make copies of the application and all relevant documents available for public review at the EPA, Region 4 Library, in Atlanta, and at the Mississippi Department of Environmental Quality (MSDEQ), in Jackson.

EPA approved the temporary unit on August 3, 1995; if the requested extension receives final approval, VCC may operate the temporary unit until August 3, 1997.

If you have any questions, please contact Judy Sophianopoulos, EPA Project Coordinator, at (404) 347-3555, extension 6408.

Sincerely yours,



James S. Kutzman, P.E.
Associate Director
Office of RCRA & Fed. Facilities

Enclosure

cc: w/enclosure

Mr. Jerry Banks, MSDEQ
Mr. Kevin Posey, MSDEQ

**U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 4
NOTICE OF INTENT TO APPROVE
AN EXTENSION FOR A TEMPORARY UNIT
AT THE VICKSBURG CHEMICAL COMPANY,
RIFLE RANGE ROAD, VICKSBURG, MISSISSIPPI,**

The United States Environmental Protection Agency (EPA), Region 4, requests public comment upon the intent of the Associate Director of the Office of RCRA & Federal Facilities to approve the application by the Vicksburg Chemical Company (VCC), for a one-year extension to the time period for a temporary unit located at the VCC site on Rifle Range Road in Vicksburg, Mississippi. This application was submitted to Region 4, in accordance with the Resource Conservation and Recovery Act (RCRA), which regulates hazardous waste. Specifically, the requirements for this kind of application are contained in the RCRA regulations for corrective action to address contamination at facilities which manage hazardous waste. The application was also submitted in accordance with Consent Decree, Civil Number W92-0008(B), between EPA and VCC, to address contamination at the site due to past production of pesticides, such as dinoseb and toxaphene. On August 3, 1995, EPA approved the use of the temporary unit for a period of one year.

VCC's temporary unit is a roofed, concrete tank-like structure which has been used, since August 3, 1995, to determine the most effective conditions for biodegradation of pesticides contained in soil at the site. The maximum time period for use of an approved temporary unit is one year. During this time period, VCC found that biodegradation was a successful treatment for the pesticide, dinoseb, and a partially successful treatment for the pesticide, toxaphene. VCC believes that additional time is needed to better define the optimum conditions for the biodegradation of toxaphene. In order to extend the time period for operating the temporary unit to a maximum of one additional year, VCC has submitted a new application to EPA, Region 4, in accordance with RCRA corrective action regulations. Also in accordance with those regulations, EPA, Region 4, requests public comment on the new application.

Copies of the application and all relevant documents are available for review by the public at:

Warren County Library
700 Veto Street
Vicksburg, Mississippi 39180
Phone: (601) 636-6411

Copies of these documents are also available for review by the public at the EPA Library, and the Mississippi Department of Environmental Quality, at the locations shown below:

EPA Library
U.S. EPA, Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365
Phone: (404) 347-4216

Hazardous Waste Division Library
Mississippi Department of
Environmental Quality
Southport Center, Ellis St. & HWY 80
Jackson, MS 39289
Phone: (601) 961-5062

Copies of all documents may be obtained by calling Dr. Judy Sophianopoulos, EPA Project Coordinator, at (404) 347-3555, extension 6408, or by writing to her at the following address:

U.S. EPA, Region 4
4WD-RCRA
345 Courtland St., N.E.
Atlanta, GA 30365

Dr. Sophianopoulos can also be reached at the following toll-free number:

(800) 241-1754.

Please leave a message with your name, address, and phone number, and Dr. Sophianopoulos will call you back as soon as possible.

Questions may be directed to Dr. Sophianopoulos, or to Mr. Steven T. Boswell, Director of Environmental Affairs, Vicksburg Chemical Company, Post Office Box 821003, Vicksburg, Mississippi 39182; Phone: (601) 636-1231.

The public review and comment period is from August 20, 1996 to October 20, 1996. Please submit comments in writing to:

Mr. James S. Kutzman, P.E.
Associate Director
Office of RCRA & Fed. Facilities
U.S. EPA, Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365.

A public meeting for discussion of the application for this extension will be held in the Warren County Library, on Tuesday, September 24, 1996, beginning at 5:45 PM and ending at 7:45 PM, Central Daylight Time.

EPA, Region 4, will take into account all public comments on this application before reaching a final decision.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

AUG 03 1995

4WD-RCRA

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Steven T. Boswell
Director of Environmental Affairs
Vicksburg Chemical Company
Post Office Box 821003
Vicksburg, Mississippi 39182

SUBJ: EPA Approval of Application for a Temporary Unit,
Pursuant to Subpart S of 40 CFR Part 264, Submitted by
Vicksburg Chemical Company, MSD 990 714 081,
to Evaluate Use of Bioremediation for
Corrective Action Required under Consent Decree,
Civil Number W92-0008(B)

Dear Mr. Boswell:

The U.S. Environmental Protection Agency (EPA), Region 4, hereby approves the application referenced above, as revised by Vicksburg Chemical Company (VCC), on May 9, 1995, in response to EPA comments. EPA also approves the request submitted by VCC on June 29, 1995, to roof the temporary unit with a one-piece fiberglass-reinforced high density polyethylene tarpaulin, anchored with bungee cord to the temporary unit exterior walls. EPA agrees with VCC that this tarpaulin will function better as a roof than the corrugated fiberglass roof depicted in Figure 3 of the revised application. Enclosed please find copies of the revised application, and the letter of June 29, 1995, which describes and presents a schematic diagram of the tarpaulin roof for the temporary unit.

During the public comment period from May 16 - July 16, 1995, EPA received no written or verbal comments, except as summarized below:

During the public meeting on June 10, 1995, one person attended. This person submitted a verbal inquiry concerning effective waste treatment technologies, and was given a copy of the application, including the draft preinvestigation evaluation of corrective measures technologies. The person did not offer a specific comment or pose a specific question on VCC's application for a temporary unit.

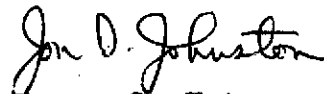
EPA's approval of the above application is effective on the date that this letter is signed, and VCC may begin the procedures

specified in the application approved as revised on May 9 and June 29, 1995.

A copy of this letter and enclosures has been forwarded to the Mississippi Department of Environmental Quality (MSDEQ). EPA and MSDEQ will provide oversight of temporary unit operations, in accordance with Consent Decree, Civil Number W92-0008(B).

If you have any questions, please contact Judy Sophianopoulos, EPA Project Coordinator, at (404) 347-3555, x6408.

Sincerely yours,



James S. Kutzman, P.E.
Associate Director
Office of RCRA & Federal
Facilities

Enclosures

cc: w/enclosures

Mr. Jerry Banks, MSDEQ
Mr. Kevin Posey, MSDEQ

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
P 388 960 432

VICKSBURG
chemical company

RECEIVED
EPA/REGION IV
JUL 5 3 50 PM '95
WASTE
COMPLIANCE SECTION

Dr. Judy Sophianopoulos
RCRA and FF Office
United States Environmental Protection Agency, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

June 29, 1995

Re: Cedar Chemical Company RFI
Consent Decree Civil Number W92-0008B
Request for a Temporary Unit

Dear Dr. Sophianopoulos:

As we discussed by telephone today, Thursday, June 29, Vicksburg Chemical desires to make a minor change to the design of the Temporary Unit proposed for operation in the Vicksburg Chemical facility in Vicksburg, MS. The change involves replacing the roofing of the unit with a tarpaulin. The tarp will be anchored by "bungee" cords attached to the exterior of the unit walls. The tarp itself will be constructed of fiberglass-reinforced HDPE (sample enclosed) and will be a one-piece unit to preclude gaps in the cover.

This change will allow for slightly greater volume to be handled in the unit and will also be much less costly to install. Ease of access to the unit for sampling and observation will be increased. Furthermore, there will be less construction material to be handled and potentially require disposal at the completion of the project.

The procedure for treatment remains essentially unchanged. Extra soil and debris plus composting medium will be added to mound-up the material in the treatment unit and support the tarp. The mounding will initially protrude approximately one foot above the top of the containment walls at the center of the unit and will be sloped to be about six inches below the walls at the edges. The tarp will be anchored on three foot centers around the unit and will overlap the edges at least one foot on all sides.

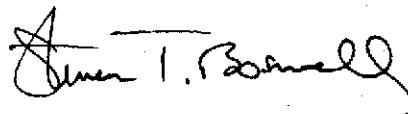
The Potassium People

P.O. Box 821003 • Vicksburg, MS 39182
Bus: (601) 636-1231 • Fax: (601) 636-5767

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
P 388 960 432

Please advise Vicksburg Chemical of your decision regarding this request. A copy of this letter will also be sent to MSDEQ for their review. Thank you for your consideration of this matter. Please contact me with any questions there may be.

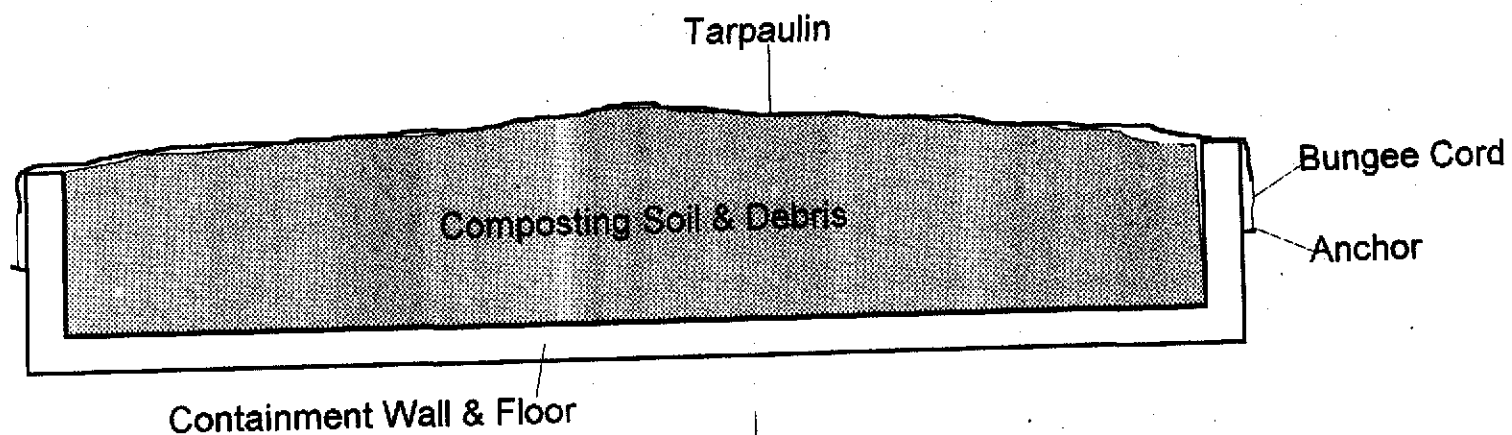
Sincerely,



Steven T. Boswell
Director of Env. Affairs

STB: pc

xc: Mr. Miles
Mr. Madsen
Mr. Posey, MSDEQ
Mr. Karkkainen, Woodward-Clyde



Vicksburg Chemical Company
Temporary Unit

6/29/95

98

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
P 388 960 433

Vicksburg
chemical company

Mr. Kevin Posey
Env. Engineer
Office of Pollution Control
P.O. Box 10385
Jackson, MS 39289-0385

June 29, 1995

Re: Vicksburg Chemical Company
MSD990714081
RFI and Civil No. W92-0008B
Request for a Temporary Unit

Dear Mr. Posey:

As we discussed today by telephone, please find enclosed a copy of a letter requesting a minor change to the Temporary Unit proposed to be created at the Vicksburg facility. Please contact me with any questions there may be.

Sincerely,

STB: pc

Steven T. Boswell
Director of Env. Affairs

xc: Mr. Miles
Mr. Madsen
Dr. Judy Sophianopoulos, USEPA, Region IV

The Potassium People

P.O. Box 821003 • Vicksburg, MS 39182
Bus: (601) 636-1231 • Fax: (601) 636-5767

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
P 388 960 432

Vicksburg
chemical company

Dr. Judy Sophianopoulos
RCRA and FF Office
United States Environmental Protection Agency, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

June 29, 1995

Re: Cedar Chemical Company RFI
Consent Decree Civil Number W92-0008B
Request for a Temporary Unit

Dear Dr. Sophianopoulos:

As we discussed by telephone today, Thursday, June 29, Vicksburg Chemical desires to make a minor change to the design of the Temporary Unit proposed for operation in the Vicksburg Chemical facility in Vicksburg, MS. The change involves replacing the roofing of the unit with a tarpaulin. The tarp will be anchored by "bungee" cords attached to the exterior of the unit walls. The tarp itself will be constructed of fiberglass-reinforced HDPE (sample enclosed) and will be a one-piece unit to preclude gaps in the cover.

This change will allow for slightly greater volume to be handled in the unit and will also be much less costly to install. Ease of access to the unit for sampling and observation will be increased. Furthermore, there will be less construction material to be handled and potentially require disposal at the completion of the project.

The procedure for treatment remains essentially unchanged. Extra soil and debris plus composting medium will be added to mound-up the material in the treatment unit and support the tarp. The mounding will initially protrude approximately one foot above the top of the containment walls at the center of the unit and will be sloped to be about six inches below the walls at the edges. The tarp will be anchored on three foot centers around the unit and will overlap the edges at least one foot on all sides.

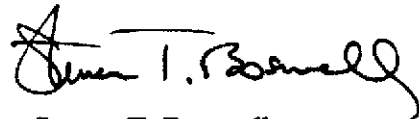
The Potassium People

P.O. Box 821003 • Vicksburg, MS 39182
Bus: (601) 636-1231 • Fax: (601) 636-5767

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
P 388 960 432

Please advise Vicksburg Chemical of your decision regarding this request. A copy of this letter will also be sent to MSDEQ for their review. Thank you for your consideration of this matter. Please contact me with any questions there may be.

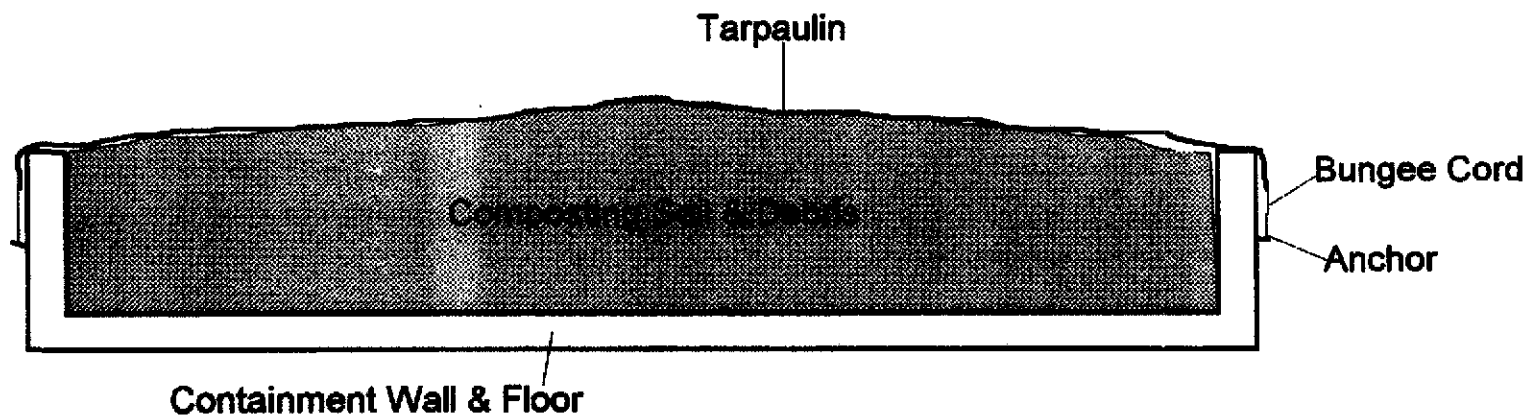
Sincerely,



Steven T. Boswell
Director of Env. Affairs

STB: pc

xc: Mr. Miles
Mr. Madsen
Mr. Posey, MSDEQ
Mr. Karkkainen, Woodward-Clyde



Vicksburg Chemical Company

Temporary Unit

6/29/95
96



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

MEMORANDUM

DATE: June 12, 1995

SUBJ: Trip Report
Public Meeting on June 10, 1995
In Vicksburg, MS, RE: Temporary Unit,
Pursuant to Subpart S, 40 CFR part 264,
At Vicksburg Chemical Company
MSD 990 714 081

FROM: Judy Sophianopoulos
Environmental Scientist
AL/MS/NC Unit
RCRA Compliance Section

TO: Jeaneanne M. Gettle
Acting Chief, RCRA Compliance Section

THRU: Shannon E. Maher
Chief, AL/MS Unit
RCRA Compliance Section

RECEIVED

JUL 24 1995

Dept. of Environmental Quality
Office of Pollution Control

The purpose of this memorandum is to summarize, in the form of a trip report, the public meeting referenced above.

BACKGROUND

On May 9, 1995, an application for a temporary unit, pursuant to Subpart S of 40 CFR Part 264, was submitted by Vicksburg Chemical Company (VCC), as part of the corrective action required by Consent Decree, Civil Number W92-0008(B), signed by EPA and Cedar Chemical Corporation, and entered on April 17, 1992. VCC is now a wholly owned subsidiary of Cedar Chemical Corporation, which is a wholly owned subsidiary of Trans Resources, Inc., New York.

VCC proposes to use the temporary unit to determine optimum conditions for biotreatment of soil and concrete at the site, which was contaminated by past production of pesticides. VCC stopped producing pesticides in 1986, and currently produces only inorganic compounds, such as nitric acid, nitrogen tetroxide, potassium nitrate, and potassium carbonate.

VCC found, during literature review and bench scale tests, that both toxaphene and dinoseb can be treated successfully using biodegradation. In addition, VCC's sister facility in Arkansas reported field scale results indicating successful biotreatment of dinoseb in soil at that site.

In accordance with Subpart S of 40 CFR Part 264, EPA, Region 4, public noticed intent to approve the application, on May 16, 1995, in the *Vicksburg Evening Post*, and announced a public comment period from May 16 through July 16, 1995, and a public meeting at the Warren County Library, 700 Veto Street, in Vicksburg, beginning at 10:00 AM (CDT) on Saturday, June 10, 1995.

The Mississippi Department of Environmental Quality (MSDEQ) was unable to be present at the meeting.

The Office of Public Affairs, EPA, Region 4, was notified of the meeting.

**PUBLIC MEETING
SCHEDULED TO BEGIN AT 10:00 AM (CDT), JUNE 10, 1995**

Hosts of the meeting, on June 10, 1995, were Judy Sophianopoulos, EPA; Steven T. Boswell, Director of Environmental Affairs, VCC; and Dick Karkkainen, Woodward-Clyde, Baton Rouge, LA, consultant for VCC. On arriving at 9:00 AM the hosts opened the meeting room doors, posted a sign giving information about the meeting, near the open doors, and had available copies of a proposed agenda for the meeting to give to attendees for their approval or suggestions for change. A copy of the proposed agenda was also given to the librarian on duty during the time of the meeting. The hosts were present from 9:00 AM - 3:00 PM; one member of the public attended, from 2:15 - 2:30 PM, and was given a copy of the proposed agenda.

This gentleman identified himself as Terrance Jackson, a Chemical Engineer, employed until recently by International Paper Company, Vicksburg, where he had experience with feasibility studies. Mr. Jackson stated that he will soon move to North Carolina and work for the Champion International paper mill. He said that he had seen the notice in the newspaper, and that the subject interested him, because, in August 1995, he will be part of a workgroup which will travel to China to help that country set up an environmental infra-structure for its paper industry. Mr. Jackson was interested in technologies for managing hazardous waste, which might be applicable to China. Mr. Karkkainen provided Mr. Jackson a copy, which he could take with him, of VCC's application for a temporary unit. Included as an appendix in the application is VCC's draft preliminary evaluation of corrective measures technologies, which includes descriptions of various technologies, as well as of biotreatment.

During the afternoon and evening before the meeting, and during the time period at the meeting when no citizens were in attendance, the hosts discussed various aspects of corrective action at VCC. Also, on the afternoon before the meeting, EPA viewed the bottles in which VCC conducted bench scale tests demonstrating biodegradation of toxaphene and dinoseb in soil or concrete, using sewage sludge as the source of microbes and sugar and ammonium phosphate as nutrients. There was a musty odor when the toxaphene test bottle was opened, and a not unpleasant, vinegary odor when the dinoseb test bottle was opened. The liquid supernatant in the dinoseb test bottle, after treatment, was pink and VCC stated that it had pH indicator properties.

- VCC stated that Cedar Chemical Corporation's Arkansas facility recently reported that dinoseb in soil at the site was biodegraded from a concentration level of several hundred parts per million down to a non-detect level, in approximately 3 months, using a compost consisting primarily of cotton gin waste.
- VCC agreed with EPA's recommendation that the RCRA Facility Investigation (RFI) include testing for dioxins, particularly in the former methyl parathion process area where a fire occurred 10 or more years ago. This is an area and an event where both chlorine and organic compounds could have been mixed and heated.
- EPA agreed to take all possible steps to expedite the review process so that the RFI can begin as soon as possible. Many activities to be undertaken will depend on the results of determining the extent of horizontal and vertical contamination, the first step in the RFI.
- EPA estimated that comments on the revised Closure Plan for Solid Waste Management Units (SWMUs) #1 and #17, and the Amended Preliminary Report and Facility Description of RFI Task I, which must be approved prior to submitting the draft RFI Workplan, could be completed and transmitted to VCC, within 2 weeks.

- VCC agreed with EPA's recommendation that, upon approval of the temporary unit, VCC should determine the products of biodegradation, as well as how much dinoseb or toxaphene has been biodegraded. This determination should, at least, confirm for a worst case scenario that none of the 40 CFR Part 264, Appendix IX hazardous waste constituents are produced; that is, that no toxic substances are produced by biodegrading dinoseb or toxaphene. VCC's application already includes determining whether volatile organics are produced.

cc: Steven T. Boswell, VCC
Dick Karkkainen, Woodward-Clyde
Jerry Banks, MSDEQ
Kevin Posey, MSDEQ
Carl Terry, Office of Public Affairs, EPA, Region 4
Carlos Merizalde, MS State Coordinator, EPA, Region 4



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

MAY 10 1995

RECEIVED
MAY 17 1995
Dept. of Environmental Quality
Office of Pollution Control

4WD-RCRA

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Steven T. Boswell
Director of Environmental Affairs
Vicksburg Chemical Company
Post Office Box 821003
Vicksburg, Mississippi 39182

SUBJ: Public Notice of EPA Intent to Approve
Application for a Temporary Unit, Pursuant to
Subpart S of 40 CFR Part 264, Submitted by
Vicksburg Chemical Company, MSD 990 714 081,
to Evaluate Use of Bioremediation for
Corrective Action Required under Consent Decree,
Civil Number W92-0008(B)

Dear Mr. Boswell:

The U.S. Environmental Protection Agency (EPA), Region 4, has completed a review of the application referenced above. EPA intends to approve the revised application, which Vicksburg Chemical Company (VCC) submitted on May 9, 1995, in response to EPA comments. Enclosed please find a public notice of EPA's intent to approve the application for a temporary unit at the VCC site on Rifle Range Road, Vicksburg, Mississippi.


Please arrange for this public notice to be published in the *Vicksburg Evening Post* on May 15, 1995, for a public review and comment period from May 16, 1995 to July 16, 1995. In addition, please arrange for the following:

1. Public review of the application and all relevant documents at the Warren County Library, 700 Veto Street, Vicksburg, Mississippi 39180; Phone: (601) 636-6411; and
2. A public meeting at the Warren County Library, on Saturday, June 10, 1995, beginning at 10:00 AM, Central Daylight Time.

EPA will also make copies of the application and all relevant documents available for public review at the EPA, Region 4 Library, in Atlanta, and at the Mississippi Department of Environmental Quality (MSDEQ), in Jackson.

If you have any questions, please contact Judy Sophianopoulos, EPA Project Coordinator, at (404) 347-3555, x6408.

Sincerely yours,



James S. Kutzman, P.E.
Associate Director
Office of RCRA & Fed. Facilities

Enclosure

cc: w/enclosure

Mr. Jerry Banks, MSDEQ
Mr. Kevin Posey, MSDEQ

**U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 4
NOTICE OF INTENT TO APPROVE A TEMPORARY UNIT
AT THE VICKSBURG CHEMICAL COMPANY,
RIFLE RANGE ROAD, VICKSBURG, MISSISSIPPI,**

The United States Environmental Protection Agency (EPA), Region 4, requests public comment upon the intent of EPA, Region 4, to approve the application by the Vicksburg Chemical Company (VCC), for a temporary unit located at the VCC site on Rifle Range Road in Vicksburg, Mississippi. This application was submitted to Region 4, in accordance with the Resource Conservation and Recovery Act (RCRA), which regulates hazardous waste. Specifically, the requirements for this kind of application are contained in the RCRA regulations for corrective action to address contamination at facilities which manage hazardous waste. The application was also submitted in accordance with Consent Decree, Civil Number W92-0008(B), between EPA and VCC, to address contamination at the site due to past production of pesticides, such as dinoseb and toxaphene.

The proposed temporary unit is a roofed, concrete tank-like structure which will be used to determine the most effective conditions for biodegradation of pesticides contained in soil at the site. The maximum time period for use of an approved temporary unit is one year. In order to extend this time period a maximum of one additional year, VCC must submit a new application to EPA, Region 4, and public comment will be requested on the new application.

Copies of the application and all relevant documents are available for review by the public at:

Warren County Library
700 Veto Street
Vicksburg, Mississippi 39180
Phone: (601) 636-6411

Copies of these documents are also available for review by the public at the EPA Library, and the Mississippi Department of Environmental Quality, at the locations shown below:

EPA Library
U.S. EPA, Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365
Phone: (404) 347-4216

Hazardous Waste Division Library
Mississippi Department of
Environmental Quality
Southport Center, Ellis St. & HWY 80
Jackson, MS 39289
Phone: (601) 961-5062

Copies of all documents may be obtained by calling Dr. Judy Sophianopoulos, EPA Project Coordinator, at (800) 962-6216, x6408, or by writing to her at the following address:

U.S. EPA, Region 4
4WD-RCRA
345 Courtland Street, N.E.
Atlanta, GA 30365

Questions may be directed to Dr. Sophianopoulos, or to Mr. Steven T. Boswell, Director of Environmental Affairs, Vicksburg Chemical Company, Post Office Box 821003, Vicksburg, Mississippi 39182; Phone: (601) 636-1231.

The public review and comment period is from May 16, 1995 to July 16, 1995. Please submit comments in writing to:

Mr. James. S. Kutzman, P.E.
Associate Director
Office of RCRA & Fed. Facilities
U.S. EPA, Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365.

A public meeting for discussion of this application will be held in the Warren County Library, on Saturday, June 10, 1995, beginning at 10:00 AM, Central Daylight Time.

EPA, Region 4, will take into account all public comments on this application before reaching a final decision.

Woodward-Clyde

Engineering & science applied to the earth & its environment

VICKSBURG CHEM CO
WARRIOR CO.
RCRA FORM.

May 9, 1995

RECEIVED
MAY 11 1995
Dept. of Environmental Quality
Office of Pollution Control

Dr. Judy Sophianopoulos
U.S. EPA
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Re: Cedar Chemical Corporation
Vicksburg Chemical Company
MSD 990714081
Request for Temporary Unit

Dear Dr. Sophianopoulos:

At Steve Boswell's direction, I have enclosed a copy of the Request for Temporary Unit. Modifications have been made that are responsive to your review and comments.

Very truly yours,



Dick Karkkainen

cc: Steve Boswell

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] 89

DRK:tlc

92B007C\SOPH.LTR VICKSBUR

REQUEST FOR TEMPORARY UNIT

**VICKSBURG CHEMICAL COMPANY
CEDAR CHEMICAL CORPORATION**

Prepared for
Vicksburg Chemical Company
Vicksburg, Mississippi

Cedar Chemical Corporation
Memphis, Tennessee

Revision 1
May 1995

WCC File 92B007C

Woodward-Clyde



Woodward-Clyde Consultants
2822 O'Neal Lane (70816)
P.O. Box 66317 (70896)
Baton Rouge, Louisiana

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INTRODUCTION

Vicksburg Chemical Company (VCC) has retained Woodward-Clyde Consultants (WCC) to perform activities associated with a RCRA corrective action program. The corrective action program is in response to a Consent Decree, Civil Number W92-0008(B). The Consent Decree requires that a RCRA Facility Investigation (RFI) be conducted at the Vicksburg, Mississippi manufacturing facility and that a closure plan be prepared for SWMU 1 - Hazardous Waste Container Storage Area and SWMU 17 - Off-Specification Product Storage Area.

The purpose of the RFI is to determine the nature and extent of releases of hazardous wastes and/or constituents from regulated units, solid waste management units (SWMUs), and other areas of concern (AOCs) at the facility and to gather all necessary data to support a Corrective Measures Study.

The RFI constitutes the second phase of the RCRA corrective action program. The program's initial phase consists of the RCRA Facility Assessment (RFA) which is conducted by EPA and precedes the RFI. The RFI itself is divided into five separate tasks which includes the Preliminary Report (submitted as a separate document in May 1992 and resubmitted as the Amended and Restated Preliminary Report in February 1994), the RFI Work Plan, the Facility Investigation, and the Investigative Analysis and Reports. In addition to these phases, a Groundwater Assessment Work Plan and Annual Groundwater Assessment Reports are required by the Consent Decree.

As part of the RFI/CMS process, VCC has prepared a Draft Preinvestigation Evaluation of Corrective Measures Technologies (PECMT) report which is a listing of technologies that may be utilized as corrective measures for the remediation of Solid Waste Management Units (SWMUs) and Area of Concern (AOC). The PECMT is a deliverable, due to the U.S. EPA and Mississippi Department of Environmental Quality (MSDEQ) 60 days after approval of the RFI Preliminary Report. As part of the technology investigation process, VCC has conducted laboratory scale tests on biodegradation of the contaminants of concern in soils and other solid media such as

concrete at the VCC site. The results of the tests are sufficiently promising that VCC wishes to proceed with pilot scale testing. This report is a Request for Temporary Unit pursuant to 40 CFR 264.553. The draft PECMT is attached as Appendix A.

This Request for a Temporary Unit contains the following information:

- **Operational Factors**
 - length of time the unit will be in operation
 - type of unit
 - volumes of waste to be managed
 - physical and chemical characteristics of the wastes to be managed in the unit
 - potential for release from the unit
- **Environmental Factors**
 - hydrogeology of the site and other environmental conditions which may influence the migration of potential releases; and
 - potential for exposure of human and other environmental receptors if a release were to occur.

This Request for a Temporary Unit also defines the activities to be executed by VCC pursuant to the establishment of a Temporary Unit and conduct of pilot plant activities.

1.1 DESCRIPTION OF THE SOUTH PLANT

The contaminated soil and concrete and the proposed location of the Temporary Unit are located within the South Plant of Vicksburg Chemical Company. Vicksburg Chemical Company is located in Warren County, Mississippi along the Mississippi River within the south section of the City of Vicksburg (see Figure 1). The address is:

Vicksburg Chemical Company
Post Office Box 821003
Rifle Range Road
Vicksburg, Mississippi 39182

The facility is a manufacturer of chemicals. The plant site is divided physically and functionally into a "north plant" and a "south plant". The north plant is primarily a manufacturer of potassium nitrate, chlorine and nitrogen tetroxide. The south plant formerly manufactured pesticides and herbicides. The south plant presently manufactures nitric acid, which is used primarily as a raw material in the north plant, and potassium carbonate (K-Carb). Some nitric acid and all the K-Carb is sold commercially.

The south plant formerly contained the manufacturing operations for production of the following products:

- Cyanazine
- Methyl parathion
- Atrazine
- Toxaphene
- Dinitrobutyl phenol (dinoseb)
- Monosodium methane arsenate
- Di Ethylhexyl Phosphoric Acid

1.2 HISTORY OF THE SOUTH PLANT

All pesticide plants were shut down by 1986 and have been dismantled. Any non-de minimis spills from toxaphene would have been handled as a hazardous waste (P123). The monosodium methane arsenate (MSMA) plant generated listed RCRA waste K031, a by-product salt. The by-product salt cake was directly discharged into a "roll-off sludge container". When the container was full (2 to 4 days) it was transported by a hazardous waste transporter to a hazardous waste landfill. The MSMA plant was designed such that there was intended to be no effluent with all spills, etc., retained and recycled to the process.

The dinitrobutyl phenol (Dinoseb) plant produced process wastewater that was hazardous by virtue of characteristic (D002). The waste was pumped to 1 to 3 day storage and was transported by a hazardous waste transporter to off-site disposal by hazardous waste deep well injection. At times the manufactured process wastewater was

neutralized with ammonia and pumped to a 1.6 million gallon storage tank. After neutralization, the water did not exhibit the characteristic of a hazardous waste and was pumped through activated carbon prior to discharge to the surface impoundment.

The SWMUs and AOCs within the south and north plant are noted on Figure 1. History and a discussion for existing data for each of the SWMUs and AOCs has been provided in detail to the U.S. EPA and MSDEQ in the Amended and Supplemental Preliminary Report submitted in February 1994. The need by VCC to utilize existing warehouse areas has resulted in investigation and corrective action at SWMU 9 the Former Dinoseb Drumming and Storage Area and SWMU 16 the Former Atrazine Production Storage Area. The investigation work plan was submitted to the U.S. EPA and MSDEQ in August 1994 and the report of finding was submitted in October 1994. Part of the corrective action was to grind the surface of concrete to allow a satisfactory bond for a concrete overlay.

The concrete grindings are contaminated and have been used as a source to test biotreatment in the laboratory as a means of destroying the contaminants. Additionally various soil areas, identified as SWMU's within the production areas of the South plant, are contaminated. The extent of the contamination is yet to be defined but there is sufficient information to establish that technology for corrective action needs to be more clearly defined.

LOCATION AND PHYSICAL DESCRIPTION OF TEMPORARY UNIT

There are two open top concrete structures adjacent to SWMU 7 and SWMU 20 that are to comprise the Temporary Unit. The structures are noted in Figure 2. The structures were formerly secondary containment structures for tanks of pesticide intermediates and formulations. The tanks have been removed. Each of the concrete structures is approximately 5 feet by 23.5 feet by 70 feet and contains one inner partition. The wall thickness of the structure is eight (8) inches.

Prior to being put in service as a Temporary Unit, cracks and holes within the concrete would be patched or caulked. A removable roof would be constructed atop the concrete structure in order to prevent rainfall from entering the structure. A typical construction detail is provided as Figure 3. The roof would be bolted onto the concrete with removable bolts, that is, the bolts would not be grouted or cemented in place. The roofs will be constructed of corrugated fiberglass with a fiberglass ridge cap and lifting lugs. Additionally, the reactors would be fitted with 2-inch PVC pipe that reaches to the bottom in order to allow water to be withdrawn, if necessary. Another 2-inch PVC pipe would reach to the bottom and would be fitted with a piece of slotted PVC pipe to allow air to be sparged through the reactor, if required.

TEMPORARY UNIT-OPERATIONAL FACTORS

3.1 LABORATORY OBSERVATIONS

The Temporary Units will be operated as aboveground biological reactors. The conditions in the laboratory that will be simulated but not duplicated are as follows:

- Reactor - stoppered bottle - anaerobic conditions
- Media - water slurry
- Nutrients - 5 percent sugar; 1 percent ammonium phosphate
- Starter bacteria - raw influent to city of Vicksburg sewage plant
- Temperature - 88° F
- Time for greater than 90 percent reduction - 3 weeks

3.2 PILOT PLANT - TYPE OF UNIT

The pilot plant reactor will not be a mixed slurry run under anaerobic conditions, but rather will be a anaerobic composting reactor. Each concrete structure will be filled with contaminated soil and/or concrete grindings and composting material supplied by Bioremediation Technology Service, Incorporated of Sonora, California. There are two concrete structures with one partition in each, so that the ratio of composting material to contaminated media might include 1 to 1, 1 to 1.5, 1 to 2 and 1 to 2.5.

3.3 PHYSICAL AND CHEMICAL CHARACTERISTICS OF WASTE TO BE MANAGED IN THE UNIT

The contaminants of concern within the mixture of compost, soil and/or concrete grindings will be the following compounds:

- Toxaphene
- Dinitrobutyl phenol (dinoseb)
- Monosodium Methane Arsenate (MSMA)

- Atrazine
- Toluene

Concentrations of the individual organic constituents when mixed with the compost will generally not exceed 1,000 to 2,000 parts per million. Arsenic is not biodegradable and is only expected to be present in trace amounts, if at all, but will be monitored since it is a constituent of concern for the site.

The finished product of the compost and soil will physically resemble gardening mulch. Those mixtures that contain concrete grindings will probably resemble gardening mulch mixed with sand.

3.4 LENGTH OF TIME THE UNIT WILL BE IN OPERATION

The Request for a Temporary Unit assumes an operational period of 1 year. Time of operation for each batch within the Temporary Unit is a major variable. The degradation of constituents will be followed versus time. The objective will be to develop data that may be relevant to the ultimate disposition of contaminated solids present on site. The information will be utilized in the Corrective Measures Study to be implemented as part of the response to the Consent Decree. It is premature to be able to ascertain the final disposition of the material treated in the Temporary Unit but one potential route of disposition is stabilization (if required by concentrations of arsenic) followed by land disposal in an on site Corrective Action Management Unit (CAMU). Any proposed disposition plan will be submitted to the U.S. EPA and MSDEQ for approval.

The objective of the treatment will be to reduce concentrations of constituents of concern to levels below the following:

Constituent	Concentration (mg/kg)
Dinoseb	80
Arsenic	24
Toxaphene	2.6
Atrazine	400
Toluene	16,000

The significance of concentrations noted above is that they have been suggested by Vicksburg Chemical Company as concentrations of constituents to consider as health based closure standards for soils and concrete under various assumptions, including the following:

- further groundwater contamination via the pathway of existing contaminated soil is not significant,
- soil ingestion of 100 mg/day is the route of exposure, and
- potential carcinogenicity of arsenic is not considered.

All the assumptions will be further developed and submitted to the U.S. EPA and MSDEQ in the RFI/CMS process.

3.5 VOLUME OF WASTE TO BE MANAGED

Initially as much as 250 cubic yards of contaminated soil and/or concrete grindings will be mixed with 125 to 200 cubic yards of composting material. Ammonium phosphate may be added as a nutrient. Assuming the batch time averages 3 months, as much as 1,000 cubic yards of waste could be treated in the Temporary Unit.

3.6 POTENTIAL FOR RELEASE FROM THE UNIT

As noted in Section 2.0, cracks and holes in the concrete structures comprising the Temporary Unit will be patched and caulked. Additionally roofs will be constructed to avoid rainwater from entering the unit and potentially causing overflow of material. The greatest potential for release exists while loading and unloading the unit. Since the unit is in a SWMU area and would be loaded with material excavated or otherwise moved from nearby already contaminated, there is no incremental potential to release caused by the operation of the unit.

3.7 ANALYSIS OF WASTE AND BY-PRODUCTS DURING PILOT PLANT TREATMENT

Samples will be obtained monthly to determine the progress of biodegradation. One composite sample will be created by obtaining six grab samples of the waste.

A summary of the parameter and possible methods to be employed by the offsite laboratory are as follows:

Toxaphene, Atrazine and Cyanazine	EPA SW-846, Method 8080
Dinitrobutyl Phenol (Dinoseb)	EPA SW-846, Method 8150
Arsenic	EPA SW-846, Method 7060
Toluene	EPA SW-846, Method 8020

The entire sample will be ground or otherwise subdivided, if necessary, such that it passes through a 1 millimeter sieve. During the extraction phase of sample preparation where acidification to pH 2.0 is required, only concentrated hydrochloric acid will be used. Sufficient hydrochloric acid will be used such that the pH remains at 2.0 during the entire extraction. The pH at the end of the extraction period will be recorded.



Every third monthly sample and the last sample (after completion of treatment) will be subject to investigative analysis by gc mass spec in order to identify existence of by-products of biodegradation. Tentatively identified compounds (TICs) will be noted quantitatively and qualitatively to a 50% accuracy using the library and experience of the analyst. The TICs will then be validated by a party independent of the analytical laboratory.

In order to monitor the potential for emissions, a Photoionization Dector (PID) will be used to obtain readings in the vapor space of the Temporary Unit, underneath the roof. The same PID will be used to obtain readings outside of the Temporary Unit in the breathing zone of personnel. If a PID reading exceeds 5 ppm, the area surrounding the Temporary Unit will be marked off and personnel entering the marked off area will be required to wear level C protective personal equipment.

ENVIRONMENTAL FACTORS

Reference is made to the Amended and Supplemental Preliminary Report submitted to the U.S. EPA and MSDEQ in February 1994. Section 4.0, Environmental Setting; Section 5.0, Nature and Extent of Contamination; Section 6.0, Potential Release Pathways and Section 7.0, Exposure and Environmental Assessment are adopted by reference.

4.1 HYDROGEOLOGY

A potentiometric contour map is provided as Figure 4. Monitor well locations are also noted on Figure 4. The groundwater in the vicinity of the Temporary Unit is monitored in monitor wells MW-8, MW-12, and MW-9. The incremental potentially adverse environmental effect of the Temporary Unit is non-existent. Contaminated material that has some potential for environmental release is to be excavated or otherwise moved into the Temporary Unit where there is a lesser potential for environmental release.

**4.2 POTENTIAL FOR HUMAN AND OTHER ENVIRONMENTAL RECEPTORS
IF A RELEASE WERE TO OCCUR**

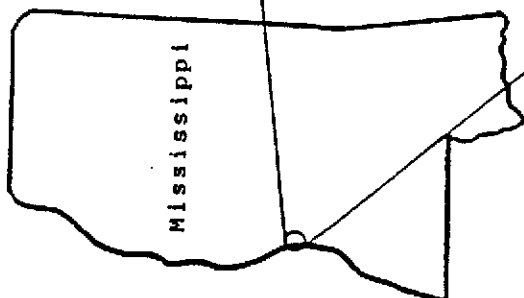
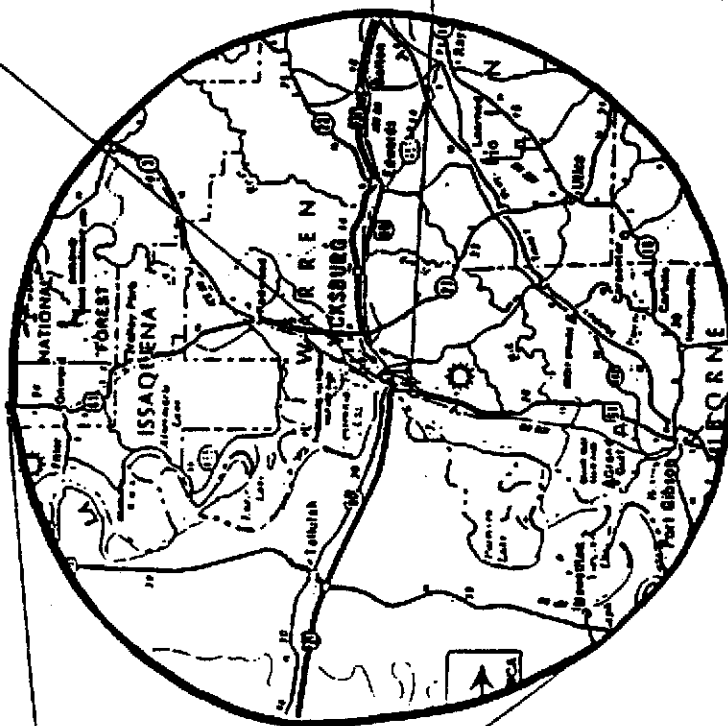
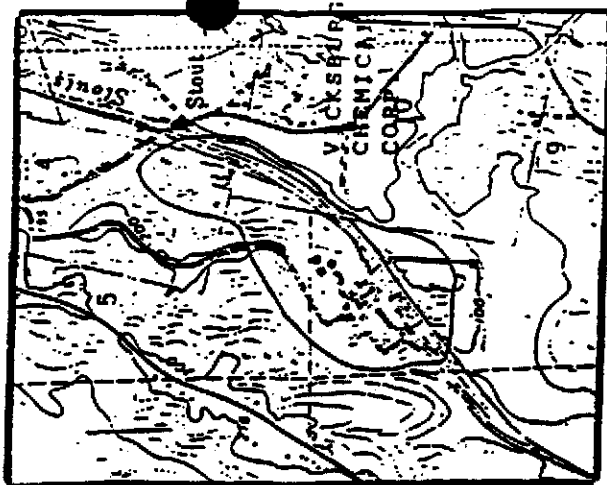
There is at present some potential for VCC workers to contact the contaminated materials. Additionally, there is some potential for release to the environment. The excavation or other movement of the materials into the Temporary Unit will reduce the potential for contact with human and other environmental receptors. The excavation or other movement of materials will be implemented by personnel with appropriate training under the auspices of a health and safety plan.

5.0

TEMPORARY UNIT CLOSURE

Temporary storage and ultimate disposition of material treated in the Temporary Unit will depend on the success of the treatment. The main objective of the pilot plant effort in the Temporary Unit is to help define the technology to be suggested in the Corrective Measure Study and later implemented. The Temporary Unit itself will be subject to the corrective action process; therefore, it is at present premature to select the method of closure.

FIGURES



EDAR CHEMICAL CORP
VICKSBURG CHEMICAL
DIVISION
VICKSBURG, MISSISSIPPI

Woodward-Clyde Consultants

Consulting Engineers, Geologists
and Environmental Scientists
Baton Rouge Louisiana



SCALE

DRAWN BY: SB

DATE 4/91

CHKD BY: *20K*

DATE 3-15-95

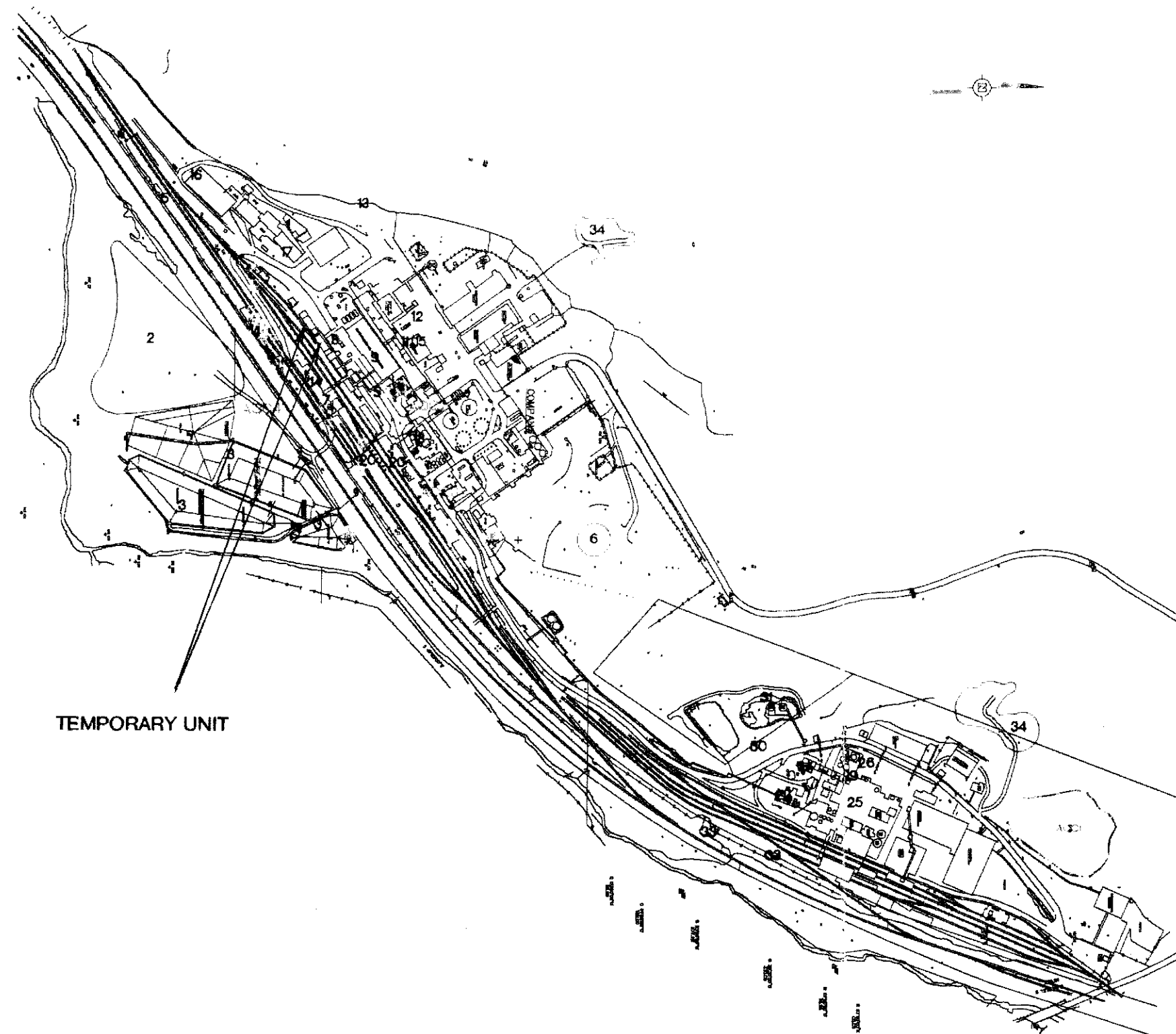
FACILITY LOCATION MAP

FILE NO

92B007C

FIG NO

1



SWMU NUMBER

SOUTH PLANT

- 1 CONTAINER (DRUM) STORAGE AREA
- 2 INACTIVE LANDFILL
- 3 SURFACE IMPOUNDMENT (SOUTH PLANT)
- 4 ACTIVATED CARBON TREATMENT UNITS
- 5 SOUTH PLANT DRAINAGE SYSTEMS
- 6 WASTEWATER STORAGE (HILL) TANKS
- 7 FORMER DINOSEB PRODUCTION AREA
- 8 DINOSEB LOADING/UNLOADING AREA
- 9 DINOSEB DRUMMING AREA
- 11 FORMER MSMA PRODUCTION AREA
- 12 FORMER MSMA SALT UNLOADING AREA
- 13 SOUTH PLANT DRAINAGE DITCHES
- 14 FORMER TOXAPHENE PRODUCTION AREA
- 15 FORMER METHYL PARATHION PRODUCTION AREA
- 16 FORMER ATRAZINE PRODUCTION AREA
- 17 RETURNED PRODUCT STORAGE AREA
- 18 FORMER BLUE TANK AREA
- 20 RAILROAD CAR UNLOADING STATION

NORTH PLANT

- 22 NORTH PLANT NEUTRALIZATION SYSTEM
- 23 EQUALIZATION/NEUTRALIZATION POND (NORTH PLANT)
- 25 NORTH PLANT WASTEWATER PIPES
- 26 C-10 SCRUBBER
- 29 OIL COLLECTION UNIT
- 30 NORTH PLANT WASTE OIL ACCUMULATION AREA
- 31 NO. 6 FUEL OIL AREA
- 33 NORTH PLANT DRAINAGE DITCHES

BOTH PLANTS

- 34 SURPLUS EQUIPMENT STORAGE (JUNKYARD)

AOC NUMBER

AOC NAME

- 1 FISH POND (NORTH PLANT)
- 2 DRUM STORAGE AREA
- 3 NEUTRALIZATION TANKS (SOUTH PLANT)
- 4 CHEMICAL CRYPT (SEPTIC TANKS)



REQUEST FOR TEMPORARY UNIT

WOODWARD-CLYDE CONSULTANTS
 Consulting Engineers, Geologists
 and Environmental Scientists
 Baton Rouge, Louisiana

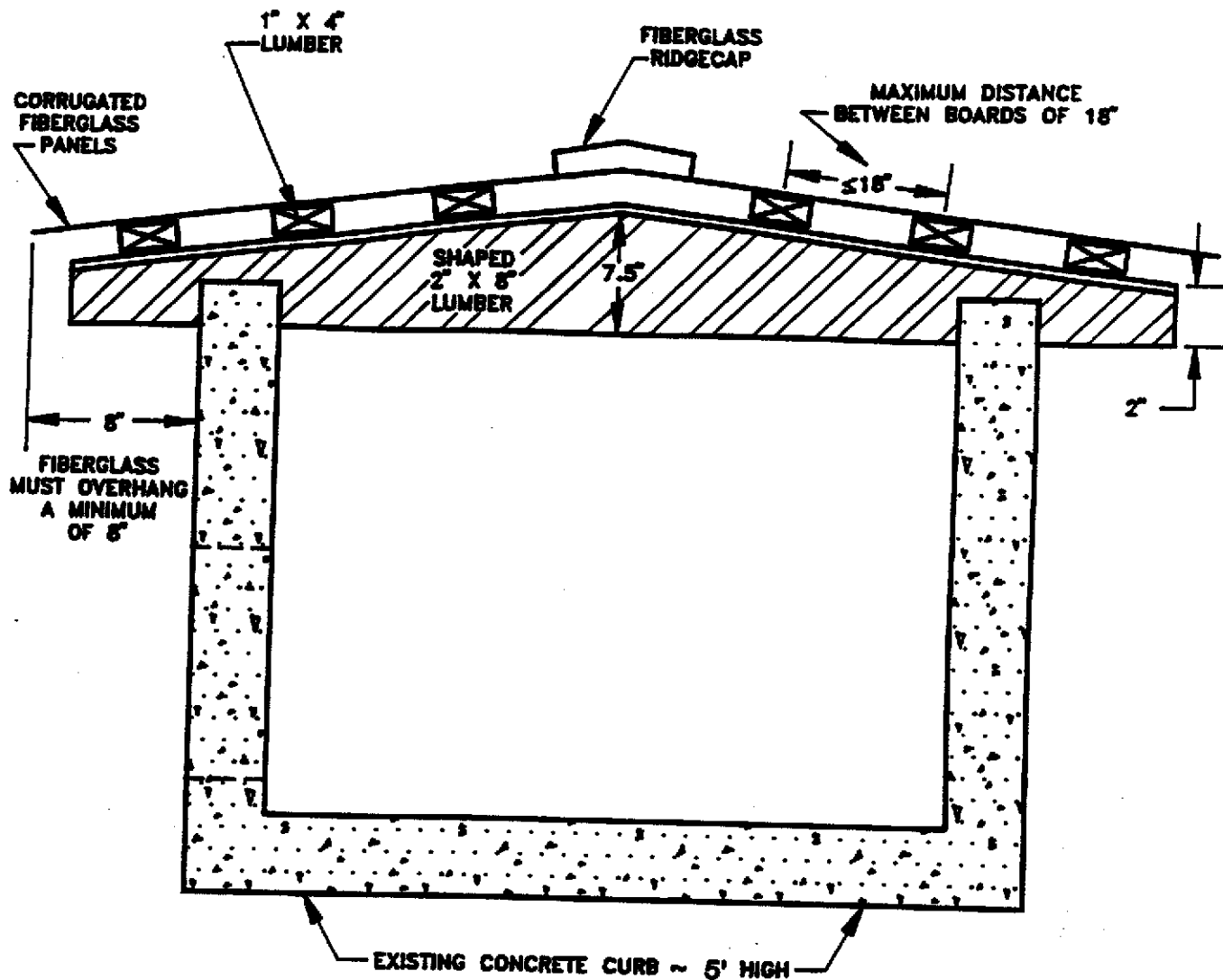
CEDAR CHEMICAL CORPORATION
 VICKSBURG CHEMICAL DIVISION
 VICKSBURG, MISSISSIPPI

SCALE: 1"=200' MADE BY: GT DATE: 4/6/92 FILE NO.: 928007C
 CHECKED BY: DATE: 4/22/92

LOCATION OF SOLID WASTE
 MANAGEMENT UNITS

FIGURE
 2

NO.	REVISION	DATE	INITIAL



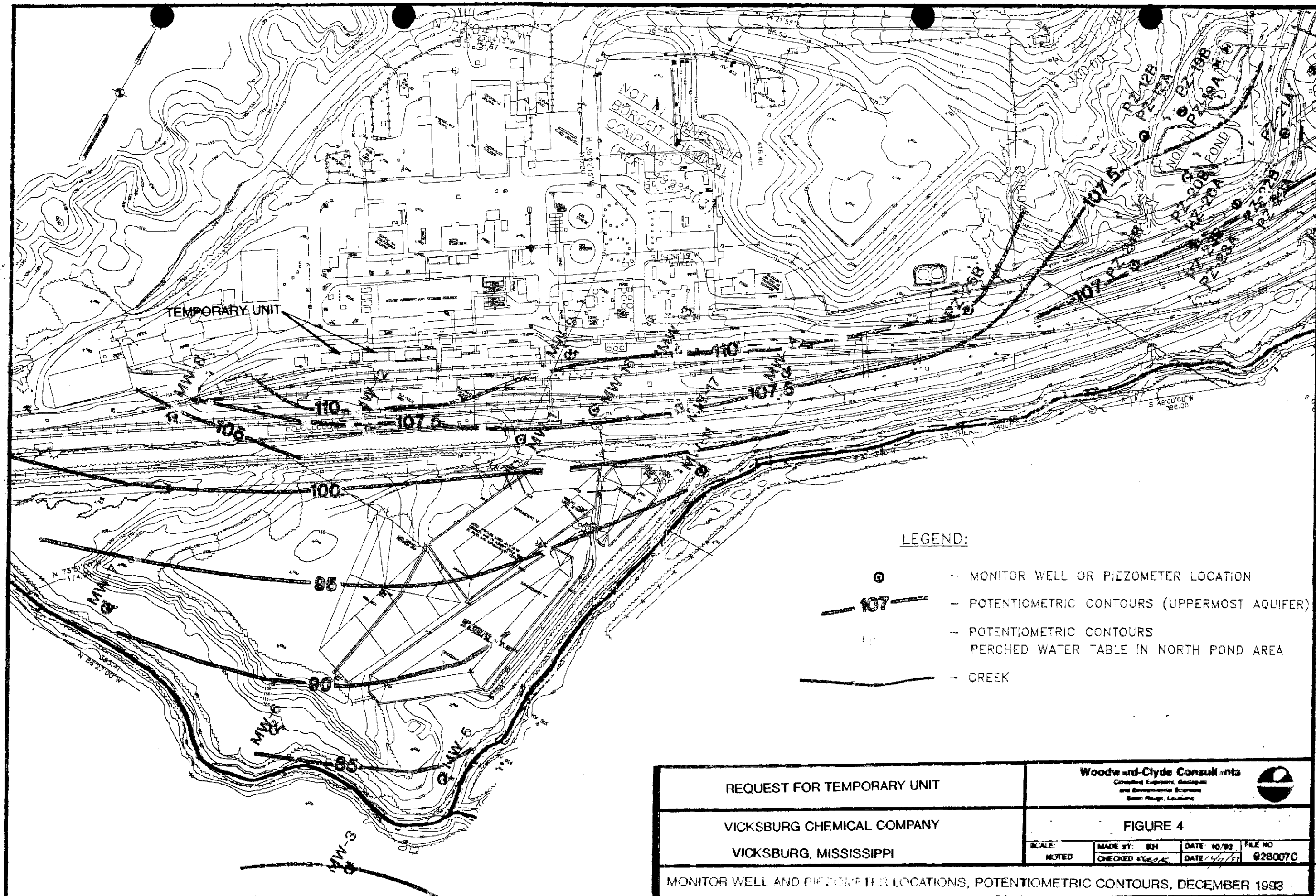
NOTES:

- ROOF BOLTED TO CONCRETE
- ROOF FITTED WITH LIFTING LUGS
- TEMPORARY UNIT IS TO BE FITTED WITH A MINIMUM OF TWO 2" PIPES PER CELL.
ONE PIPE IS SOLID FOR WITHDRAWAL OF WATER
ANOTHER PIPE IS FITTED WITH A SLOTTED PIECE FOR AIR SPARGING

**CUT AWAY VIEW
NOT TO SCALE**

Location: B.R.LA File name: K:\DWG\CEDAR\28007083.DWG Last edited: 07/24/92 @ 13:21

<p>CEDAR CHEMICAL CORPORATION VICKSBURG CHEMICAL VICKSBURG, MISSISSIPPI</p>	<p>Woodward-Clyde Consultants Consulting Engineers, Geologists and Environmental Scientists Baton Rouge, Louisiana</p> <p>SCALE: N.T.S. DRAWN BY: J. RICHFORD DATE: 6/15/92 CHKD. BY: ROK DATE: 2/16/95</p>	<p>TEMPORARY UNIT TYPICAL CONSTRUCTION DETAILS OF THE ROOF COVER</p>	<p>FILE NO 92B007 FIG. NO 3</p>
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APPENDIX A

**PREINVESTIGATION - EVALUATION OF
CORRECTIVE MEASURES TECHNOLOGIES**

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INTRODUCTION

This Preinvestigation Evaluation of Corrective Measures Technologies (PECMT) report is a listing of technologies that may be utilized as corrective measures for the remediation of Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at Cedar Chemical Corporation's Facility in Vicksburg, Mississippi.

Cedar is conducting a RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) in response to a Consent Decree effective on Day 0. A work plan for the RFI activities has been submitted as a separate document. Concurrently with the RFI/CMS, Cedar is conducting certain Interim Measures (IM) and also a Groundwater Assessment (GWA). Separate work plans have been submitted for the IM and GWA. A summary of the initial submittals to the EPA and MSDEQ and other significant events are as follows:

Document or Event:	Submittal or Event Date:
Consent Decree Effective Date	Day 0
RFI Preliminary Report	Day 30
IM Work Plan	Day 30
Closure Plan for Container Management Area	Day 60
EPA Approval of RFI Preliminary Report	Day X
RFI Work Plan	X + 60 or less
GWA Work Plan	X + 60 or less
PECMT Report	X + 60 or less

**2.0
OBJECTIVES**

Solid Waste Management Units (SWMUs) and Areas of Concern (AOC) have been identified in the RCRA Facility Assessment, Consent Decree and RFI Preliminary Report. Implementation of the Interim Measures, RFI Field Investigation and Groundwater Assessment will yield definitive data on the contaminants and extent of contamination on soils and within the groundwater. Nevertheless there is sufficient existing data on the contaminants and range of concentrations expected to be found in soil and groundwater to be able to list technologies that are applicable to the site. Detailed discussions of existing data are found in the RFI Preliminary Report.

It is the objective of this report to identify potential corrective measures technologies that may be used on-site or off-site for the containment, treatment, remediation, and/or disposal of contamination. The emphasis will be on source control technologies. There may be ancillary pump and treat technology associated with source control, therefore, pump and treat technology will also be discussed. This report will also identify any field, laboratory, bench, or pilot scale data that needs to be collected during the RCRA facility investigation to facilitate the evaluation and selection of the final corrective measures (e.g., compatibility of waste and construction materials, information to evaluate effectiveness, treatability of wastes, etc.).



TECHNICAL CONSIDERATIONS FOR CLEANUP

This preinvestigation-evaluation concentrates on technologies available to meet requirements of Cedar at its Vicksburg Facility. Consideration is given to evaluating various remediation solutions that will satisfy federal and state cleanup standards. An analysis will be performed on those technologies during the conduct of a feasibility study to determine which technique will effectively remedy the problem and do so in a cost-effective manner. In this report, particular emphasis is placed on those technologies that offer remediation and cost-effective, on-site treatment.

A clear definition of the goals of a remedial action program along with an understanding of the site-specific parameters and the technical and economic limitations of the technologies under consideration will allow selection of the most effective treatment option. The site-specific chemical, geologic, and hydrogeologic parameters are subjects of the RFI Field Investigation. By consideration of those parameters along with the available technologies, specific recommendations for further work will be made during the feasibility study.

3.1 PROBLEM DEFINITION

No single treatment technology will be universally applicable for all corrective action. A thorough evaluation of all the site-specific parameters is necessary in order to select the most technically suitable and cost-effective treatment technology for the job. Because major corrective action programs, especially those involving source control and aquifer restorations, are likely to take several years to completely accomplish, the investment of time and effort to properly evaluate the site initially will more than pay for cost/benefit evaluation in the long run. The following generalized parameters are among those that should be defined.

3.2 CONTAMINANT COMPOSITION AND CONCENTRATION

Previous analysis of the site contamination has been made by Cedar, EPA, and MSDEQ. The level of contamination ranges from several hundreds of parts per million pesticides in the soil to parts per billion pesticides in the groundwater. With an understanding of the type of contaminant, concentration of contaminant, and desired removal rates, technologies can be correctly applied. Technologies such as carbon adsorption and oxidation are dependent on concentrations and type of compound while technologies such as air stripping are more closely related to the treatment rate and desired removal efficiency.

3.3 DESIRED CLEANUP CRITERIA AND EFFLUENT DISPOSITION

Stringent cleanup criteria will eliminate some technologies from consideration because they will not meet the criteria within reasonable time frames. The ultimate disposition of the effluent or residues after treatment will have significant bearing on the treatment method.

3.4 VOLUME TO BE TREATED

Treatment volumes, defined by the horizontal and vertical extent of contamination, are not well defined at this point. A small volume may be best treated by a technology with low capital costs with possible high operating costs, while remediation of a larger magnitude is more likely to be accomplished utilizing an equally effective technology with lower operating costs. An evaluation of treatment options should include consideration of leasing equipment to treat small volume sources or purchasing equipment for treatment of large volume sources.

3.5 FATE OF TREATMENT BY-PRODUCTS

The disposition of treatment by-products must be considered in the choice of the treatment solution. Local requirements for disposition of treatment by-products will have a major impact on the viability and economics of various treatment technologies. Air stripping of groundwater can be an extremely effective technology if the organic-

laden air can be emitted directly to the environment; but compliance with RCRA, the Clean Air Act, and in certain areas strict local air emission standards may require that air stripping be followed by air pollution control equipment such as a vapor-phase adsorption system. Similar considerations exist with the generation of potentially toxic by-products from chemical oxidation processes, or the possible need for nutrient removal (phosphorus and nitrogen) from the effluent of biological oxidation processes. The economics of using activated carbon adsorption is affected by the accessibility of an approved regeneration site for the contaminated carbon.

3.6 UTILITIES AVAILABILITY AND COST

The selection of certain technologies will be influenced by the availability of utilities, such as steam at the treatment site. Likewise, some processes such as oxidation in the presence of ultra violet light can require a substantial resource of electrical power. The energy-intensive processes area also likely to be more attractive in certain parts of the country where electrical costs are less than in other regions.

3.7 LAND USE

At Cedar where normal production is ongoing, the operation of treatment systems or maintenance of closed facilities can be accomplished with the existing operations staff. The intention is that the processing areas and waste areas in the Vicksburg site remain an industrial site in perpetuity as a covenant maintained by deed restrictions.

3.8 IMPLEMENTATION TIME

The system to be used for remediation must be capable of being installed quickly enough to satisfy agency requirements.

3.9 EFFECTIVENESS

The proposed method and system for cleanup must accomplish containment of the source of contamination and effective removal of the contaminants that may be in the aquifer in a reasonable time.

3.10 LIMIT FUTURE LIABILITY

Cleanup must be accomplished in a way that will have minimal future liability for additional environmental remediation.

3.11 COST EFFECTIVENESS

A cleanup system should be selected that will accomplish the required remediation in the most cost-effective manner for both initial and long-term operations.

3.12 MINIMAL INTERFERENCE WITH NEIGHBORS

Installation and operation of the remediation system should cause minimum interference with the property and operations of adjacent property owners.

REMEDIAL ALTERNATIVES

The categories of remedial alternatives that are being considered in the preevaluation are as follows:

- **Groundwater Remediation**
 - Section 4.1 Containment Systems
 - Section 4.2 Hydraulic Control Systems
 - Section 4.3 Groundwater Treatment
- **Soil Remediation**
 - Section 4.4 Stabilization and Chemical Fixation
 - Section 4.5 Thermal Treatment
 - Section 4.6 Solvent Extraction
 - Section 4.7 Biological Degradation
 - Section 4.8 Off-site Disposal

The actual remediation for each SWMU or AOC may be a combination of the above. Specific technologies within the categories are discussed below.

4.1 GROUNDWATER REMEDIATION - CONTAINMENT SYSTEMS

Zones of contaminated groundwater may be contained by various barrier systems or hydraulic control systems. Barriers control the vertical inflow of surface water or groundwater through the contaminated soil zone. Surface caps, grading, vegetation, diversions, and collection systems can be used for control, containment, or collection of surface water. These technologies prevent run-on, control vertical infiltration, prevent erosion, collect and transfer water for treatment, store and discharge treated water, and protect against flooding.

Containment barriers such as bentonite slurry walls, grout curtains, vibratory beams/asphalt walls, or steel sheet piles are vertical walls that prevent migration of contaminated water out of an area or prevent flow into an area. These types of containment barriers are utilized in soil layers that transmit water horizontally.

4.1.1 Surface Cap

A cap system provides a mechanism for surface water runoff control. This eliminates contact of the wastes with air and minimizes infiltration/leaching of the rainfall which consequently controls the risk of contamination or further contamination of the near-source subsurface soils, rock and/or groundwater.

A cap prevents direct contact with any waste which may be left on site. Should all the waste be removed or treated to render it nonhazardous and immobile, then a cap system would not be necessary. Core component materials used in the construction of a cap are relatively impermeable to minimize infiltration and reduce the potential for contaminant migration to the groundwater; such materials may include synthetic membranes, compacted natural soils, cement or bituminous asphalt pavements, or chemical sealants/stabilizers.

Synthetic membranes are generally plastic/resin based materials which have low permeability compared to other materials. Membranes are typically made of butyl rubber, hypalon, PVC, ethylene, propylene diene monomer (EPDM), or high density polyethylene. The membranes are manufactured in sheets which require field installation to form a single cover for an area. The membranes may be subject to physical degradation and damage resulting from improper handling and installation.

A clay soil cap provides a natural low permeability barrier and is constructed using earth moving equipment to spread and compact the clay. Clay is not subject to appreciable physical deterioration and consequently is a durable long-term material. The clay is susceptible to cracking if exposed at the ground surface.

An asphalt cap is a more permeable barrier than the synthetic membrane. Asphalt is relatively flexible and, due to weathering and cracking, would require periodic long-term

repair. The asphalt could be applied as paving with a sealant, to provide a relatively thick, semi-permanent material.

Concrete is also more permeable than synthetic membranes and is susceptible to cracking. A concrete cap would require maintenance on a periodic basis.

Chemical sealants/stabilizers can provide permeability characteristics similar to that of the clay cap and in many cases are merely added to improve the sealant characteristics of on-site or imported clays. Adding lime to clay, for example, would reduce the shrink/swell properties if the clay were used without a cover.

A drainage zone of highly permeable material typically overlies the low permeability zone of the cap in order to enhance lateral drainage of infiltrating rainwater. A soil/vegetation zone is usually provided at ground surface to provide erosion stabilization by promoting vegetative cover without penetration of the cap by plant roots.

Synthetic membranes provide the least permeable barrier and consequently restrict the infiltration of rainfall but, left unprotected the membranes are subject to deterioration. A clay cap would be most durable if not exposed at the surface. The synthetic membrane augmented by the durability of natural clay cap may provide the optimum cap with the compacted clay overlain by the synthetic membrane. Protection of the synthetic membrane is also required. A free draining sand, with a vegetated soil cover, would serve a dual purpose of allowing storm water to run off more rapidly to site surface drainage channels, and prevent direct exposure of the membrane to the environment.

4.1.2 Grading, Diversion and Collection Systems

Grading of a site is performed to reduce the potential for erosion. Grading is reshaping of the contours of the existing ground surface to allow storm water runoff to drain without scouring away the topsoil, thereby protecting the cap and minimizing the potential for infiltration.



A number of technologies can be used for the control, containment or collection of surface water. Water exclusion measures include barriers and landscaping techniques. These technologies are designed to perform six basic functions; prevent run-on, control infiltration, prevent erosion, collect and transfer water for treatment, store and discharge treated water to a drainage ditch or sewer, and protect against flooding. A surface water management system may require a combination of technologies to minimize the production of leachate and prevent off-site contamination.

Dikes and berms are compacted earthen ridges designed to divert or retain surface water flow. They can be used to control flood water eliminating the potential for cap scour/erosion and also the potential for standing flood waters to infiltrate the cap. Also, control of runoff will reduce erosion potential.

Seepage basins and seepage ditches are used to discharge water collected from surface water diversions or groundwater pumping. Both types discharge collected water to the groundwater by allowing it to seep through the ground.

Channels are excavated ditches that are generally wide and shallow. Diversion channels are used primarily to intercept runoff or reduce drainage runs across slopes.

Terraces are embankments or combinations of embankments and channels constructed across a slope. Terraces can be used to intercept and divert surface flow away from a site to control erosion by reducing slope drainage runs.

Sedimentation basins are used to control suspended soiled particles in surface water flow. They can be part of the water treatment process, and their design will depend on that process and the amount of solids in the surface water.

Grading, diversion systems and collection system are an effective means of control, containment or collection of surface water and therefore and protective of cap barriers by means of minimizing the potential for erosion and infiltration.



4.1.3 Revegetation

Revegetation can perform several basic functions: it can stabilize soil and earthen structures against wind and water erosion by intercepting rainfall, slowing runoff, and holding soil together with a tight root system. Vegetation can reduce the quantities of water available for runoff through interception, infiltration, uptake and transpiration and can sometimes treat contaminated soil and leachate through the uptake and removal of waste constituents, nutrients, and water from soil.

Vegetation also can improve the aesthetic appearance of a site. Plants used for revegetation include various types of grasses, legumes, shrubs and trees. A vegetation program involves a careful plant selection, land preparation (such as increasing soil depth, grading, fertilizing and tilling), seeding and maintenance. As part of the selection process, consideration should be given to the remedial action implemented in conjunction with revegetation. For example, a cap would require a mix of grass such that it is covered throughout the year, whereas, a backfill could be revegetated with a lower maintenance cover.

Selection of vegetation will depend on site-specific requirements and plant characteristics. In general, grasses provide quick and lasting dense growth. They effectively anchor the soil, have high evapotranspiration characteristics, and may be suitable in wet areas such as waterways. They do, however, require periodic mowing and maintenance. Legumes, on the other hand, are a low maintenance cover providing long-term protection. They are most useful for stabilization and erosion control. They also have the added benefit of increasing the soil fertility through nitrogen fixation. Shrubs are useful in providing a dense surface cover and are tolerant to acidic soils. Trees are most suited for preparing a site for post-closure use.

4.1.4 Containment Barriers

Containment barriers are vertical walls installed to provide a more impermeable zone through a soil layer which transmits fluid horizontally. The two basic applications are to prevent migration of contaminated fluids out of the area defined by the barrier or prevent flow into the area enclosed by the barrier, primarily for dewatering purposes.

For the first application, the barrier is able to contain contaminated water in shallow aquifers to limit the extent of horizontal migration. Once containment by the barrier is established, contamination is either left in the groundwater and further isolated by placing a cap over the entire contained area, or a removal and treatment/disposal program is initiated to remove contaminated groundwater while minimizing the volume of groundwater requiring pumping. With the second application, the barrier may also function to reduce the dewatering requirements of excavations which extend beneath the water table to remove contaminated soil or wastes.

Containment barriers include the following:

- Soil bentonite slurry wall
- Cement bentonite slurry wall
- Grout curtains
- Vibratory beam/asphaltic wall.

A soil bentonite (SB) slurry wall is a method frequently utilized to contain hazardous waste migration. It involves excavating a 2 to 3 foot wide trench, extending beneath the contaminated zone to be cut off. The excavated soil (or clean import soil) is mixed with a bentonite slurry (also used in the trench to keep it open) and then pushed back into the trench. The SB slurry sets up as a flexible gel, which retards fluid flow. As a thick flexible wall, it will be adversely affected by ground movements associated with settlements or creep of subsurface formations. A permeability of 10^{-7} cm/second or less is usually achievable with a properly designed and constructed SB wall. Further, slurry walls may be constructed to function as "skimmer walls" to cut off movement of lighter than water constituents, or as full penetrating walls, keyed into a "bottom" formation which is itself a barrier to vertical movement of contaminated groundwater; this also affects the movement of heavier than water constituents.

A cement bentonite (CB) slurry wall is constructed by excavating a 2 to 3 foot trench and maintaining slurry in the trench. The slurry, a mixture of cement and bentonite, sets up as a more rigid wall than the SB was and consequently is frequently used around a deep excavation because it can be placed closer to the edge of the excavation without a resulting slope failure. A CB wall is more permeable than a SB wall and is also more

expensive. It is usually not possible to achieve a permeability significantly lower than 10^{-6} cm/second.

Grout Curtains can be constructed by pumping grout down into a permeable zone to seal off the contained area. The grout can be either a particulate or a chemical grout which fills the voids between the soil particles. Considerable control is required to ensure a water tight seal; placement of the curtain generally involve injections at a 4 to 8 foot spacing and possibly more than a single row of holes.

A vibratory beam wall is a thin (about 3 to 4 inches wide) asphaltic or cement bentonite mix wall which is installed by driving wide-flange H-section beams through the permeable zone. As the beam is withdrawn a void is created into which a relatively impermeable asphaltic or cement bentonite mix is injected. A wall is created by overlapping the sections. The cement bentonite mix will generally achieve a lower permeability of about 10^{-6} cm/second; the asphaltic mix can generally achieve a lower permeability. The vibrating beam wall is more subject to gaps than a soil bentonite wall. Because of its narrow width, it will also directly transmit more water than a soil bentonite wall. Its main advantage is in locations which do not have adequate space or stability for trenching, such as in areas where numerous subsurface pipelines or other subsurface obstacles are present.

4.2 GROUNDWATER REMEDIATION-HYDRAULIC CONTROL SYSTEMS

With hydraulic-control approaches, an aquifer is pumped in order to remove contaminated water, which is then disposed of off-site (with or without treatment) or reinjected on-site (after treatment). When one or more wells are used for hydraulic control, the wells must be located and constructed such that they (1) prevent the chemical plumes from escaping, i.e., reverse the flow of contaminated groundwater, and (2) recover the majority of the total mass of contaminants, which are usually concentrated near the center of the plume. With extensive plumes, many wells are required both to control the plume and to recover the water that is contaminated.

Hydraulic control with wells is a viable alternative for control and elimination of the chemical plumes in aquifers that have significant saturated thickness and are permeable.

In aquifers where saturated thickness of groundwater is only a few feet or where the sediments have low permeability, pumping wells have very small radii of influence.

Recovery trenches are excavated through the saturated zone to intercept the flow of groundwater or free phase contaminant and eliminate migration of chemicals past them. Recovery trenches are well suited to situations where the depth to groundwater and the saturated thickness are small. They become cost-prohibitive when depths are too great for excavation with standard equipment. Recovery trenches are also restricted when surface features, such as buildings, trees, or heavy paving, or subsurface features, such as large boulders, hard to excavate soils, or buried utilities, interfere with excavation.

4.2.1 Groundwater Pumping, Well Systems

Groundwater pumping can achieve the following:

- Gradient control or migration control in which the groundwater withdrawal establishes a hydraulic flow regime which eliminates or minimizes migration of contaminated groundwater to sensitive areas; and/or
- Contaminant removal, in which contaminated groundwater is pumped from the aquifer until the aquifer contamination reaches acceptable levels.

Groundwater pumping could be necessary depending on the assessment of risk of further horizontal and vertical migration of the contamination. Groundwater pumping for gradient control can be adequate for controlling horizontal migration but is generally not adequate where vertical migration is a major risk. Pumping for contaminant removal can be adequate control for both horizontal and vertical migration. Groundwater pumping may not be necessary if neither horizontal nor vertical migration presents a risk to public health or the environment.



Typical groundwater pumping scenarios are as follows:

- Pumping of the contaminated zone to control horizontal migration, remove contamination and reduce the risk of vertical migration; or
- Limited pumping of pressure relief wells within a barrier wall containment area to prevent possible rise in water levels within the contained area.

Groundwater pumping involves the following basis elements;

- Collection system (well)
 - Well points
 - Recovery wells
- Pumping system
- Recovered fluid handling system (storage, treatment, disposal).

Well Point collection systems consist of relatively closely spaced shallow wells connected to a central manifold suction lift system. Well points are usually small diameter (1.5 to 2 inch inside diameter) and are commonly installed by jetting techniques, or less commonly, by borehole drilling techniques.

Well point systems are subject to certain limitations including:

- Lift is limited to one atmosphere of pressure minus friction losses and system inefficiencies, usually the equivalent of about 25 feet or less.
- Drawdown within the well should not exceed the depth to the top of the well screen.

Use of the well point method often requires very close spacing of a large number of low pump rate wells. This technique is potentially applicable for remedial actions requiring

gradient control along a limited perimeter of contamination. Contaminant removal over a large area would probably require a prohibitively large number of well points.

Recovery wells are generally drilled boreholes into which well screen, sand/gravel pack, well casing and borehole annulus seals have been placed. Well diameters of 4 inches or greater are generally used. Wells can be designed for recovery of dissolved phase contaminants, lighter than water free phase liquids, heavier than water free phase liquids, or a combination of different contaminant phases. With appropriate pumps recovery can be utilized in deep well systems.

Recovery rate, well spacing, and total number of wells required is primarily determined by hydrogeologic conditions. The main requirement is that sufficient flow rates are maintained to create a gradient toward the recovery wells.

Pumping systems for the recovery wells could include submersible pumps, jet pumps, positive displacement pumps or ejector pumps. Submersible pumps are generally better suited for deep, high yielding wells. Selection of the pumping system is also dependent or desirability of preferential recovery of free phase liquids and required discharge pressure. Wells and pumps may be designed to preferentially scavenge (recover) lighter than water phases from the groundwater. Specific pumping equipment selection requires evaluation of detailed recovery schemes.

Materials of Construction

When recovery systems are designed, consideration must be given to the effective life of the components, with respect to the chemical environment into which they will be installed. After detailed review of the operating environment, it may be determined that expenditures on exotic materials such as stainless steel, etc. may not extend the life of the recovery system. Contaminated groundwater may not be constant in quality with space and time and what is compatible at the initiation of the recovery system may not be compatible in the future.

The area where the greatest amount of improvement can be made is the compatibility of pumping equipment with the contaminated groundwater. Most recovery wells using

standard off-the-shelf water well equipment result in frequent pump failure because of attack on the pumps by chemicals. Pump failures include chemical attack of the pump and motor casings, deterioration of the plastic and elastomer seals, fittings, and cable sheaths. Low flow aquifers create situations where pump motors are run at temperatures in excess of manufacturer's design and experience subsequently shorter lives. Frequent cycling and pumping of abrasive materials also contribute to shortening of pump life. Pumps are being introduced into the market that will operate effectively in contaminated low flow environments. These pumps, many of which are operated with air, are expensive and still subject to failure during the life of the remediation project.

Well screens are also subject to failure as a result of chemical attack, corrosion, or mechanical plugging. When plugging occurs because of geo-chemical or biological reactions of the waste, the materials of construction have little effect. The plugging can be migration of sediment fines, chemical scales or biologic fouling.

Maintenance of Recovery System

In planning for a recovery system, consideration must be given to system maintenance. Recovery wells or trenches will not operate for the length of time required to clean up contaminated aquifers without maintenance during the life of the project. The wells and trenches must be designed and installed in such a manner so that "workovers" can be performed.

Many recovery systems are designed today based upon the results of transmissivity values derived from pumping test/recovery test. Using these values, well spacing programs have been developed to insure overlapping cones of depression. However, in many contaminated aquifers the zone of saturation is thin. If the well is inefficient, water levels in the pumping wells may drop to a point where very reduced pumping rates are required. Although the water level in the well may be low, the water level in the aquifer will be higher and overlapping cones of depression may not be maintained.

Corrosion and scaling of water wells and oil wells have long been problems. These historical problems in uncontaminated areas are magnified many times when dealing with contaminated aquifers that are often unstable from both a geochemical and

geologic standpoint. The effects of the contaminants on the gravel pack, and slots of the well screen are very unpredictable. Many recovery wells require extensive maintenance to keep screens open. Replacement of recovery wells at 4-year intervals is not uncommon and clean-out operations at 6-month intervals. In terms of cost of operations, recovery well maintenance may be a large cost factor.

4.2.2 Subsurface Collection Drains and Trenches

Subsurface collection drains and trenches include several variations but all involve placing linear permeable collection devices in the subsurface which collect fluid which is then pumped out from sumps.

Subsurface collection drains include:

- Tile drains
- Pipe drains
- French drains

Utilization of drains involve placement of the drains to depths sufficient to intercept contaminated groundwater. The system must be capable of intercepting the entire thickness of the aquifer. Tile drains and pipe drains only intercept a thin section of a saturated zone.

Difficulty of construction of french drains is a function of the following:

- Thickness of the aquifer
- Head within the aquifer
- Depth of the aquifer
- Trench stability problems resulting from the above

French drains or trenches may be potentially applicable for intercepting lighter than water phases present on the groundwater at some locations. For this purpose, the drain or trench would not need to penetrate the entire aquifer. The drain or trench would involve the following:

- Excavation of a trench on the downgradient perimeter of the floating phase layer to a depth of at least a few feet below the floating phase layer, and
- Placement of a synthetic liner on the downgradient side

If the trench were to be completed as a french drain, the following steps would be necessary:

- Placement of a perforated collection pipe in the trench
- Backfilling with sand/gravel to above the top of water
- Clay cap over the surface
- Installation of a sump or sumps containing a pumping system
- Means of handling and disposing pumped groundwater and excavated soil

4.3 GROUNDWATER REMEDIATION-TREATMENT

Treatment systems for recovered contaminants are typically the same systems that are in use for treating various waste streams from industrial facilities. For example, air stripping has been used conventionally for many years in the treatment of industrial effluent. This technology is now being used to treat groundwater contaminated with fuels. The use of activated carbon for aquifer restoration programs is widespread, especially for treating water to meet drinking water standards. Most treatment applications are specific to the type of contaminant in the recovered water. Treatment technology includes biological treatment for organic wastes, chemical oxidation for organics that do not respond to biological treatment, gas stripping for removal of volatile materials.

4.3.1 Air Stripping

Air stripping has conventionally been used in the treatment of industrial effluents. Within the last 10 years the technology has been used to treat contaminated groundwater, especially those groundwaters contaminated with fuels. The limiting factor is the organic carbon emissions which may be regulated. The technology is relatively

simple and generally has low maintenance requirements. Air stripping is a contaminant removal technique based on concentration differentials between a liquid phase and a contacting gas phase. As air is contacted with a contaminated water streams in a stripping tower, the concentration differential drives the organic contaminant from the liquid to the gas phase.

Air stripping is most applicable to compounds of a volatile nature with relatively low solubility in water. Chlorinated organics such as trichloroethylene, 1,1,1 trichloromethane and aromatic compounds such as benzene and toluene are good examples. The overall applicability of the technology can be expanded to compounds with lower Henry's law constants by preheating the water prior to its entering the stripping column.

Air stripping is effective in removing the aromatic gasoline components from groundwater at normal groundwater temperature of 50°F. However, as would be expected, air stripping is ineffective in removing more soluble components of gasoline such as tert-butyl alcohol.

The major advantage of air stripping is its low overall treatment costs. Both capital and operating costs requirements are low compared to most other technologies. In many cases, however, air emission standards will require that air stripping be used in conjunction with a vapor-phase adsorption unit, significantly affecting the cost-effectiveness of the technology.

4.3.2 Carbon Adsorption

The use of activated carbon adsorption for aquifer restoration programs is widespread. Several literature sources indicate the ability to achieve exceptionally good effluent quality, and the EPA has endorsed it as the preferred treatment method for meeting drinking water standards. Three basic ways in which carbon can be used are:

- Throwaway carbon basis
- Thermal regeneration basis
- Nondestructive regeneration basis

Throwaway Carbon

One way to consistently ensure good effluent quality is to use activated carbon adsorption on a once-through carbon basis. Virgin carbon is capable of removing a broad range of organic contaminants to low parts per billion levels. A once-through carbon adsorption system is easy to operate, requiring a minimum of operation attention, and the capital cost requirements are relatively low.

Unfortunately, carbon treatment costs associated with once-through carbon adsorption systems are very high. The large treatment volumes and/or high concentrations usually associated with remedial programs results in a high carbon consumption rate. In addition, hazardous substances loaded onto activated carbon make the carbon a hazardous substance, requiring disposal in an approved hazardous waste facility.

Thermal Regeneration

The most common regeneration technique for activated carbon is thermal oxidation, usually accomplished in a multiple hearth, fluidized-bed or rotary-kiln furnace. A thermal regeneration unit can be built at the treatment site, but the level of carbon consumption associated with most remedial programs usually makes it more economical to utilize a thermal regeneration service.

Nondestructive Regeneration

There are two ways that granular activated carbon would be nondestructively regenerated at the Cedar Site.

- Using steam for volatile organics
- Using a solvent for a wider variety of organics

Steam has long been used to desorb volatile organics from vapor-phase adsorbers. Application of steam regeneration of activated carbon to wastewater treatment is an extension of this technology. After the lead carbon bed has been loaded in the usual manner, regeneration is accomplished by passing steam through the bed to a condenser.

The waste-organic condensate is then either decanted (for water immiscible solvents) or forwarded to a distillation step for recovery (for water miscible solvents).

Solvent regeneration of adsorbent involves the use of a solvent phase to desorb the organic chemicals from the adsorbent. The solvent is then removed (as in conventional solvent vapor recovery systems) by steam. The only requirement is that the organics to be removed be soluble in a common solvent. Solvents such as methanol, acetone, benzene, and methylene chloride have been used.

Regeneration is accomplished by contacting the spent carbon bed with the solvent found to be most effective. The solvent regenerate is distilled to recover solvent, leaving an organic concentrate suitable for recovery or incineration. (When a solvent already employed in the process is used to regenerate, added equipment for distilling the solvent may not be needed). The carbon, now saturated with solvent, is restored to adsorptive capacity by steaming off the solvent. The steam plus solvent vapors are condensed and separated. With solvent regeneration, the cycle of adsorption - desorption can be repeated many times before the carbon has to be replaced. Typical designs call for carbon replacement after 100 cycles.

4.3.3 Synthetic Polymer Adsorption Process

Adsorption systems consist of columns loaded with synthetic polymer adsorbents. Flow can either be down (fixed bed operation) or up (expanded bed operation). Loading rates are typically within the range of 2 to 8 US gal/min per ft² of bed cross section. The columns can be arranged in series or parallel, depending on the requirements.

The design of adsorption systems requires a knowledge of the equilibrium capacity (isotherm) of the adsorbent for the solutes to be removed and the overall rate of adsorption, factors normally determined by laboratory techniques. Column performance data at the temperature and pH of the system are generally required in order to obtain breakthrough curves to enable design for a specific effluent quality.

4.3.4 Biological Treatment

Biological waste treatment is a generic term applied to a variety of processes that utilize active microorganisms to convert wastewater or contaminant constituents to more stable forms. As the name implies, biological treatment is applicable only to those materials that are biodegradable. While certain inorganic chemicals (e.g., ammonia, reduced sulfur compounds, etc.) are recognized to be amenable to biodegradation, the technique is most commonly utilized to achieve the stabilization of organic matter. Biological treatment processes essentially simulate the biological reactions that would occur in the environment. However, since biological processes generally employ high concentrations of active microorganisms, under controlled conditions, the decomposition rates of degradable materials are vastly accelerated.

Biological oxidation uses active microorganisms to biodegrade organics to acceptable forms. The two major forms of biological treatment are aerobic, which produces CO_2 and H_2O and anaerobic, which produces CO_2 and CH_4 . Biological treatment is getting increased attention as a remedial alternative because of its potential for in situ treatment. Bioreclamation is basically just the use of indigenous soil bacteria to degrade organic contaminants. Nutrients, such as oxygen, and specific biological cultures can be added to enhance the degradation.

Bioreclamation (In situ Biological Treatment)

In situ bioreclamation is a method for remediating groundwater aquifers contaminated with hydrocarbons through the addition of nutrients and oxygen into the subsurface. The results in enhanced growth and activity of naturally occurring bacterial that use the organics as source of carbon and energy. Since most contaminated soils do not contain the optimum concentrations of all the necessary elements for bacterial growth, natural biodegradation, though present is not rapid enough to cleanse aquifers of gross amounts of contaminants. The enhanced bioreclamation process provide the oxygen, nitrogen, phosphorus and trace minerals needed to increase the natural biodegradation process.

There are a number of site specific factors which can impact enhanced bioremediation by altering the capacity of the indigenous microorganisms to grow and degrade the

contaminant. In general, microbial degradation of contaminants in the subsurface is controlled by the same factors that control these processes in surface waters and biological treatment facilities which include but are not limited to: microbial viability, nutrient availability and specific contaminant chemistry. These variables must be assessed and understood for each in situ bioreclamation project before an effective remediation strategy can be developed and implemented.

The basic principles involved in the assessment and design of an in situ bioreclamation project differentiate in-situ bioreclamation from surface biological treatment.

Above Surface Bioreactors

The major process equipment in biological treatment is basically a reactor to provide contact between the contaminated groundwater and the microorganisms, a solids-liquid separation device (such as a settling tank), sludge recycle pumps, and monitoring and control devices. Equipment for pH control and/or nutrient addition may also be required. Highly concentrated or variable waste loads may necessitate the use of an equalization tank before treatment. Finally, solids handling devices for final sludge treatment and disposal may be necessary. Descriptions of other variant schemes are given in the following paragraphs.

Aerobic Biological Treatment Systems may be subdivided into suspended growth and attached growth processes. Suspended growth processes utilize mixing mechanisms to suspend biological solids in a mixed liquor. Attached growth processes involve the contact of contaminants with biological films which are attached to a support medium.

The conventional activated sludge process is the most common example of an aerobic suspended growth process and consists of the following steps:

- Primary sedimentation to remove settleable organic and inorganic solids
- Aeration of a mixture of contaminated groundwater and a biologically active sludge

- Separation of the biological sludge from its associated treated liquor by sedimentation
- Return of settled biological sludge to be admixed with the raw wastes

Activated sludge processes can be classified according to the design process loading factor, or food-to-microorganism (F/M) ratio, which is commonly expressed as the rate of organic loading (kg BOD/day) per unit weight of biomass (kg mixed liquor volatile suspended solids). High rate processes are commonly operated at an F/M of 0.5 or greater, while "conventional" activated sludge systems are normally designed for an F/M in the range of 0.2 to 0.5. Extended aeration processes, with organic loading rates less than 0.2, provide longer detention times than conventional systems and achieve higher removals of organic matter and greater destruction of bio-solids through endogenous respiration. Such systems thus minimize the amount of sludge requiring disposal. System selection often involves an economic balance between the relative costs of increased aeration tankage and solids handling facilities.

In fixed-film biological treatment process, the biomass that affects degradation of contaminant components grown in the surface of a supporting medium. Historically, the most commonly applied aerobic fixed-film process has been the trickling filter. In its simplest form, the trickling filter is comprised of a cylindrical tank, filled with graded rock media. Recovered contaminated groundwater is applied to the surface via a series of rotating distributor arms, allowed to pass through the bed, and collected at the bottom. Oxygen transfer and biodecomposition are achieved by diffusion through the slime layer that grows on the media. Several process modifications have been applied to trickling filters, including multistage designs, recycle, and forced-draft aeration. Most modern trickling filters utilize plastic media designed to promote water flow over a large surface area while maintaining a high void ratio for adequate oxygen transfer and alleviation of plugging problems. The principal advantages of trickling filters, in comparison to suspended growth processes, have been operational simplicity and low cost. However, since trickling filters can seldom achieve the increasingly more restrictive discharge limitations, few systems have been designed in recent years.

The rotating biological contactor (RBC) is an attached growth system consisting of a series of large diameter discs that are mounted on a horizontal shaft and slowly rotated

in a tank. Approximately 35 to 40 percent of each disc is immersed in the contaminated water to be treated. The organisms present in the groundwater adhere to the discs, eventually forming aerobic biological layers. During operation, the discs rotate and pick up a thin film of contaminated water from which the organisms remove organic materials and oxygen. In comparison to suspended growth systems (such as activated sludge), the RBC System generally entails a higher capital cost, but requires lower operating costs

The historical application of anaerobic processes has been primarily for digestion of primary and water activated sludges in industrial waste treatment. More recently, anaerobic processes have been seriously reconsidered as an economically attractive alternative to aerobic processes, particularly for pretreatment of higher strength industrial wastewaters, severely contaminated groundwater and contaminated solid media. Anaerobic processes require no oxygen, thereby eliminating the capital and operating costs of oxygen transfer equipment. Moreover, methane, as a by-product of the biological reaction, may be recovered for use as a fuel. Both suspended growth and fixed film anaerobic processes have been considered for treating contaminants.

The anaerobic contact process is a suspended growth anaerobic process. The process may be operated as a two-stage system, involving two anaerobic digesters in series. The contaminated water is fed to a high rate digester, and the sludge from this digester is pumped to a second-stage digester. The second-stage digester operates as a settling basin to permit the removal of microorganisms for the water. The biological organisms, as in the activated sludge process, are returned to the first-stage digester along with the raw waste. A more recent variant of the anaerobic contact process employs a single-stage digester, followed by a proprietary solids-liquid separation device, from which solids are returned to the reactor.

Applicability

Biological treatment has been widely used in the treatment of aqueous organic wastes and contaminants but has fundamental limitations. The biodegradability of organic compounds has been shown to vary widely among different chemical structures. Many factors make it difficult to determine the biodegradability of a compound based solely

on its molecular structure. These factors include the size and solubility of the molecule, the presence of more than one functional group in the molecule, and isomerism. Chemical or biochemical changes may occur in the compound so that its capacity for biological oxidation is different than for the original compound. Also, the type of biological organisms, the environmental conditions, and the effects of acclimatization may determine whether a specific compound is biodegradable.

In general, biological processes are applicable to the treatment of soluble, degradable organics in the concentration range of 0.01 to 1 percent. Removal efficiencies can vary from 50 to 99+ percent (BOD or COD), depending on the process configuration, loading factor, and the nature and distribution of organic material present in contaminated groundwater.

An example of using both chemical and biological oxidation involved treatment of a chemical spill with alkaline hydrogen peroxide. This chemical oxidation process was successful in reducing the spill concentrations to a level where biological oxidation could be used. This biological process made use of a portable aeration tank, a spray system and railroad ballast. Liquid was pumped from a sump dug next to the ballast, passed through the aeration tank, and sprayed back onto the ballast. The system was inoculated with a specially cultured microorganism that would degrade the spill. The ballast, being composed of coarse rock, supported the growth of the biological medium in a manner similar to a trickling filter. Nutrients were added to the systems as needed. After one month, the system successfully reduced the contaminant concentration from several hundred parts per million to less than 1 ppm.

4.3.5 Chemical Oxidation

Chemical oxidation is used to chemically modify waste streams either by completely oxidizing the organics to CO_2 and H_2O or by partial oxidation of the organics in order to detoxify them. These waste streams are often aqueous wastes that cannot be handled directly by biological oxidation (either because of organic strength or bioinhibitory characteristics) or incineration (because the organic concentration is too low or there is excessive corrosion caused by the presence of inorganic salts or halogens). Oxidation

is also used to purify aqueous streams (such as waste sodium chloride brines) to permit recycle.

Most of the chemical oxidation processes are based on one of two oxidizing -- agents chlorine or oxygen. Chlorine is generally not used for remediation because of the potential to create toxic byproducts. Many oxidation processes have been developed to modify the ability of these oxidizing agents to accomplish specific goals. These modifications usually seek to adjust the stoichiometry and/or kinetics of the chemical reactions.

Because of the varying optimum conditions for the effluent reactions, no one chemical oxidation process can be considered. The ones that come closest to being universally applicable (catalyzed and uncatalyzed wet oxidation) are the most expensive in terms of capital and operating costs. These processes are usually reserved for the tougher oxidation problems because the easier problems can be handled by the cheaper processes.

Selection of a process is usually based on process economics, which in turn depend on the contaminated groundwater volume, reaction stoichiometry, and kinetics. Considerations of the completeness of the oxidation and the formation of by-products are becoming more and more important as more data on trace levels of materials are developed.

4.3.6 Volatilization

Volatilization is defined as a process where the components of a liquid mixture are separated by virtue of the differences in volatility of the components into a liquid-phase product and a gas or vapor-phase product. There are as many different types or categories of volatilization as there are mixtures to be separated. In general, volatilization can be divided into four major categories: fractional distillation, steam stripping, evaporation, and inert gas stripping.



Fractional Distillation

Distillation is applicable to the separation of components from virtually any liquid mixture, including aqueous-organic and organic-organic liquids. It is also an integral part of many contaminant treatment and/or recovery processes such as carbon adsorption and solvent extraction. Depending on the nature of the separations required, distillation is a practical and very widely used separation technique.

To produce a degree of separation by distillation, a number of successive vaporization and condensation operations are usually required. This is accomplished by causing the boiling liquid and a saturated vapor to contact each other counter-currently in a distillation column. Countercurrent contacting of the gas and liquid streams in a distillation tower is achieved by causing either the gas to be dispersed in the liquid or the liquid to be dispersed in a continuous gas phase.

Steam Stripping

Steam stripping is a special case of distillation which is directly applicable to removing volatile organic and/or dissolved gases from contaminated groundwater.

Ordinarily, heat is applied at the base of a distillation tower by means of a heat exchanger (boiler). When an aqueous solution is to be fractionated to give the nonaqueous solute as the distillate (overhead vapor product), and the water is removed as residue (bottom product), the heat can be provided by using open steam at the bottom of the tower. The distillate is a mixture of volatile solute and steam. For water-immiscible organics, phase separation yields an organic distillate.

The design and operation of a steam stripper for removing dissolved impurities from water is primarily dependent on relative volatility, just like other distillations. The relative volatility is the basis for the heat requirements to boil groundwater and cause a greater fraction of the volatile organic to separate into the vapor phase as compared to the fraction remaining dissolved in groundwater. The relative volatility ($\alpha_{1,2}$) of the ratio of vapor to liquid composition for the two components under consideration is:

$$a_{12} = \frac{Y_1/X_1}{Y_2/X_2}$$

where:

Y = fraction in a vapor

X = fraction in a liquid

In the case of steam stripping, the first component is the impurity and the second is water. For a heterogeneous azeotrope involving water, the aqueous phase is saturated with the organic solute at the azeotrope temperatures. The azeotrope composition reported is the vapor phase composition. The relative volatility of the solute to water in a steam stripper is the ratio of the composition in the azeotrope vapor to the compositions in the saturated aqueous phase at the azeotrope temperature.

The preferred application of steam stripping is the removal of organic compounds or solvents which are contained in contaminated groundwater at dilute concentrations. If the relative volatility of an impurity to water in a steam stripper is greater than 4.0, the steam stripping may be an economically viable alternative for aquifer cleanup. If it is less than 4.0, extraction or carbon adsorption may be more economically attractive.

Gas Stripping

Volatile materials can be removed from a solution by passing a gas such as air or nitrogen through the mixture. The volatile component or components transfer from the liquid phase to the vapor phase. This can be accomplished stagewise in a column similar to steam stripping. A gas stripping system normally requires that the gas from the top of the column be treated in some manner to remove the stripped material before it is discharged to the atmosphere or sent to an existing flare or incinerator for destruction. In the common case of air or nitrogen stripping of organics from water, the organics are removed from the gas by carbon adsorption.

The principal applications of air or inert gas stripping would be the same as that for steam stripping -- removal of volatile components from contaminated water. Gas

stripping might be preferred over steam stripping when the contaminants to be removed are very volatile and a column is not required. Capital and carbon regeneration costs for gas stripping are normally higher than the capital and steam costs required for steam stripping, depending on the flow and volatility of the contaminants. In many cases, the off gas (air) can be flared or sent to an incinerator, thereby eliminating the cost of gas treatment.

4.4 SOIL REMEDIATION-STABILIZATION AND CHEMICAL FIXATION

Fixation of toxic waste attempts to render it insoluble. The waste is immobilized in a normal earth environment to form a less leachable product. This can be accomplished by addition of chemicals, surfactants, or complexing agents. If Land Disposal Restrictions (LDR) are applicable to the waste being treated and the waste has a high concentration of organics, then stabilization may not be applicable since Land Disposal Restrictions for organics are based on total concentrations rather than leachable concentrations. There are instances where LDR are not applicable and organic as well as inorganic contaminants can be effectively stabilized.

The cost of chemical fixation is a function of the amount of additives, particularly proprietary polymers, that need to be added to bond or encapsulate the waste and the extent to which mechanical equipment is required to handle the processing.

In the event that soils are stabilized and chemically fixed, a containment system is constructed around the soil. In addition hydraulic control systems may be utilized in conjunction with the containment structure. Section 4.1 and 4.2 discuss the appropriate technologies.

4.4.1 Fly Ash and/or Kiln Dust

Samples of sludge can be mixed in various proportions with fly ash and kiln dust. Results must be acceptable for both structural strength and leaching characteristics. Organic compounds should be targeted as the difficult compound to immobilize.

4.4.2 Conventional Pozzolanic Treatment

Addition of large amounts of cement (perhaps 15 to 40 percent) will form a sample of adequate structural strength. Laboratory tests must be determined for leaching characteristics.

4.4.3 Proprietary Polymers

The Hazcon process uses cement and a proprietary additive called "Chloranan" to immobilize and encapsulate hazardous waste into a concrete-like mass. Cement based solidification involves the mixing of wastes directly with Portland Cement, a readily available construction material. However, Portland Cement alone is not effective in immobilizing organics. The Hazcon additive Chloranan acts to neutralize the inhibiting effect that organics normally have on the hydration of cement. The relatively high concentrations of organics will require more Chloranan to be added to the waste to allow the concrete to properly cure. The Hazcon process does not claim to fix organics, only to result in a solidified product with physical properties that inhibit mobility of the organics and additionally will support construction equipment.

Since the Hazcon process depends upon the cement to treat the waste, immobilization of the metal constituents can be expected because most multivalent cations are converted into insoluble hydroxides or carbonates at the pH of typical cement mixtures. However, mildly acidic leaching solutions as rain, will allow metal hydroxides and carbonates to leach out of solution. For this reason disposal should be in a facility with multiple liners and a leachate collection system.

Chem Fix is a silicate based process which uses proprietary formulas of siliceous materials, lime, cement and special setting agents to solidify, stabilize and chemically fix hazardous waste. Most silicate based processes employ a typical silicate material as fly-ash or other pozzolanic material as additives. Soluble silicates such as sodium silicate or potassium silicate can also be used. Additives can include selected emulsifiers, surfactants, and absorbent.

The IWT hazardous waste treatment technology is based on solidification, stabilization and chemical fixation. IWT employs three sets of functional chemical groups including cement matrix chemistry, free radical and ion attack chemistry, and organophilic linking mechanisms.

4.5 SOIL REMEDIATION - THERMAL TREATMENT

Onsite thermal treatment by fully pre-packaged ready to operate transportable modules are readily available and accepted by the technical and regulatory community. The acceptance has not spread to the neighborhood and environmental groups.

4.5.1 Incineration

Three types of modular incinerators have been considered:

- Rotary kiln
- Circulating bed combustion
- Infrared

Rotary Kiln

The rotary kiln incinerator is the most versatile. The feed systems and the kiln can handle a wide spectrum of waste materials. Solid feed is introduced by gravity into the rotary kiln combustion system which operates below atmospheric pressure in a closely controlled air supply mode.

The kiln ashes (soil) are cooled in a moisture controlled environment and conveyed to storage when they are sampled for verification of full treatment.

The kiln gases are incinerated in a secondary combustion chamber designed to handle large variations in gas composition and volumes and to avoid any operating problems which may be caused by entrainment of fine solids in the kiln gas.



The secondary combustion chamber gases are water quenched and then processed through a high efficiency air pollution control module capable of removing submicron particulate matter and acid gases. Treated gases are exhausted by a induced draft through a stack which includes an automated, computer controlled monitoring system.

There are many sizes of rotary kiln modular units available. Thermal capacity ranges from 10 million BTUs per hour to 60 million BTUs per hour. Mobilization costs can range upwards of 1 million dollars for the large incinerators that are designed to handle large quantities of wastes. The smaller incinerators cost less to mobilize but are more expensive to operate per unit of throughput.

Circulating Bed Combustion

Circulating bed combustion is an outgrowth of conventional fluidized bed incineration. However, the circulating bed operates with higher velocities than conventional fluid beds and it recirculates the fluidized material within the system returning solid, liquid, sludge, or gaseous waste streams. The advantages of this incinerator are similar to those of a conventional fluidized bed system with lower susceptibility to corrosion of the boiler, a less complicated scrubbing, close temperature control and dry solid waste recovery.

The circulating bed combustor incinerates hazardous wastes in the presence of an entrained bed of solids. Rather than maintaining a fixed fluidized bed, this process utilizes much higher gas velocities to entrain the solids in a combustion chamber. The high turbulence and resulting high heat-transfer efficiency allow the system to operate at much lower temperatures than are typically encountered in a hazardous waste incinerator. Solid wastes are added along with limestone in the solids return line. Liquid wastes are injected into the bottom of the unit. Combustion occurs at 1450°F to 1600°F and is attained at these relatively low temperatures because of the high degree of turbulence in the combustion chamber, and because of efficient heat transfer from the recirculating solids of the waste stream.

Entrained solids are removed from the combustion gases in an integral cyclone. The solids are returned to the combustion chamber through a nonmechanical seal and reentered the combustion chamber within about 50°F of their exit temperature.



Particulates (including ash) that are not removed by the cyclone remain entrained in the combustion gas. This gas passes through a heat recovery/filtration system prior to discharge to the atmosphere. In the steam generation mode, water is preheated by the combustion gas, and then flows through "water wall" tubes in the combustion chamber.

NO_x formation is minimized by the relatively low combustion temperatures, and by the addition of secondary combustion air at higher locations in the combustor. Because the circulating limestone absorbs halogens, phosphates, and sulfur, a scrubbing system may not be needed to remove acid gases.

The existing circulating combustion bed incinerators are large, mobilization cost will exceed 1 million dollars.

Infrared Incinerator

Infrared conveyor furnace combustion uses silicon carbide resistance heating elements to volatilize organics from conveyed solids, soils and sludges. The organic gases are then destroyed in a secondary chamber or afterburner.

The system consists of a waste preparation system, feed metering system, infrared primary chamber, supplemental propane-fired secondary chamber, exhaust gas scrubber, data acquisition and control systems, and heating element power centers, all mounted on transportable trailers. The compact, size of a typical unit allows for relatively quick and low cost mobilization.

Waste material is first processed in waste preparation equipment designed to reduce particle sizes to dimensions that can be handled by the incinerator. After leaving the waste preparation equipment, the feed is weighed. Waste material is then fed to a hopper mounted over the furnace conveyor belt. A feed chute on the hopper distributes the material across the width of the conveyor belt. The feed hopper screw speed is used in conjunction with the conveyor belt speed to control the feed rate and bed depth.

The incinerator conveyor, a tightly woven wire belt, moves the waste material through the insulated heating modules (primary unit) where it is brought to combustion

temperature by infrared heating elements. Rotating rakes gently stir the material to ensure adequate mixing and complete burnout. When the material (ash) reaches the discharge end of the furnace, it is cooled with a water spray. The material is then discharged by means of screw conveyors to an ash hopper.

Combustion air is supplied to the primary unit through a series of overtire air ports located at various points along the length of the chamber, and flows countercurrent to the conveyed waste.

Exhaust gases exit the primary chamber near the feed module to a secondary chamber (afterburner), where propane-fired burners are used to ignite any organics present in the exhaust stream, and burn them at a predetermined set-point temperature. Secondary air is supplied to the afterburner to insure adequate excess oxygen levels for complete combustion. Exhaust gases from the secondary chamber then pass through a scrubber type pollution control system (PCS) to the exhaust stack. The infrared unit is indeed portable and can be mobilized in less than one month.

4.5.2 Thermal Desorption

Incineration is often not considered favorably in a study of alternatives because of perceived high capital cost, high operating cost and high exposure to publicity in the permitting process. The thermal treatment proposed here involves indirect heating in a nitrogen atmosphere in a multipass screw flight dryer. This thermal treatment or thermal desorption may be more acceptable because:

- The capital requirement is moderate
- Operating cost is moderate
- It would not require a RCRA incinerator permit although it would require an air permit and a RCRA permit as a miscellaneous unit pursuant to 40 CFR 264 Part X
- There would be less tendency to volatilize heavy metals

A screw flight dryer is an indirect hollow-screw jacketed-trough thermal dryer for dewatered filter cake. The screw rotates, pushing the material down stream while a

heat transfer fluid flows through the screw and jacket, drying the material. The vapors are removed by operating under pressure with an inert gas passed through to carry the vapors away from the discharge end. The vapors are passed through a cyclone to remove entrained soil then to a cooler to condense organics. Non-condensed gas could be recycled to the inert gas stream with a purge stream to a flare or vent. The process is well defined but untried. In order to proceed along this route without risk, a pilot program should be run to determine rate of throughput, maintenance downtime due to fouling, and optimum operating temperatures. It would take an additional eight months to construct a commercially sized treatment unit if one is not now available.

4.6 SOIL REMEDIATION SOLVENT EXTRACTION

Resources Conservation Company (RCC) has a process they refer to as the B.E.S.T. process. They have constructed a modular unit and have successfully operated on oily sludges at a Superfund Site. The process takes advantage of the fact that triethyl amine (TEA) solvent and water are miscible at 50°F and undergo a phase separation at 120°F.

The basic steps in the process are:

- Extraction of oil and water from the solids with TEA at approximately 50°F
- Drying of the solids to remove residual TEA and water
- Heat exchange of the single phase effluent from the contractor to bring about TEA/water phase separation
- Distillation of the decanted water to reduce its TEA concentration
- Distillation of the decanted TEA/oil mixture to recover purified TEA for recycle and produce oil

4.7 SOIL REMEDIATION BIOLOGICAL DEGRADATION

Landfarming, which involves biological degradation, may be a viable alternative in the study of alternatives because of the large amount of land in the south plant and the time available to achieve degradation. Another option is to biologically degrade organic compounds to below clean up levels in a liquids solids contactor. A liquid solids



contractor is an aerobic reactor that uses high speed mixers. The objective is not 100% degradation of organics but rather degradation of objectionable leachable compounds to safe action levels. The residuals would then be treated and/or stabilized by conventional methods to appropriate levels.

EPA's Region 10 has evaluated composting as an ex-situ solid phase biological treatment technology to degrade nitroaromatic and nitramine compounds in soils. Treatability studies at two National Priority List sites — the Umatilla Army Depot Activity site in Hermiston, Oregon and the U.S. Naval Submarine Base site in Bangor, Washington — demonstrate that composting is a treatment alternative to incineration for remediating these compounds.

Composting mixes natural organic amendments, such as manure, wood chips, alfalfa, vegetable processing wastes and cotton gin wastes with 30 to 70 percent contaminated soil and adds water to 50 percent of moisture holding capacity. The process utilizes native aerobic thermophilic microorganisms and requires no inoculation. Composting operates under mesophilic [30 to 35 degrees Centigrade (C)] and thermophilic (50 to 55 degrees C) conditions, with thermophilic conditions being optimum.

Composting residues will support the growth of vegetation after treatment, unlike incineration ash or soils treated by solidification/stabilization. The final volume increase in soil is approximately 50 to 100 percent, similar to stabilization/solidification technologies. Composting is suitable for soils and sludges. Composting does not appear to be particularly sensitive to soil type.

Some pilot effort would be required to optimize the method.

4.8 OFFSITE TREATMENT AND DISPOSAL

The offsite treatments available are incineration at a permitted RCRA incinerator with disposal of ash at a RCRA hazardous waste landfill or direct disposal of remediation waste which meet LDR standards at a RCRA hazardous waste landfill.



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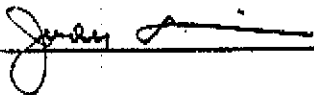
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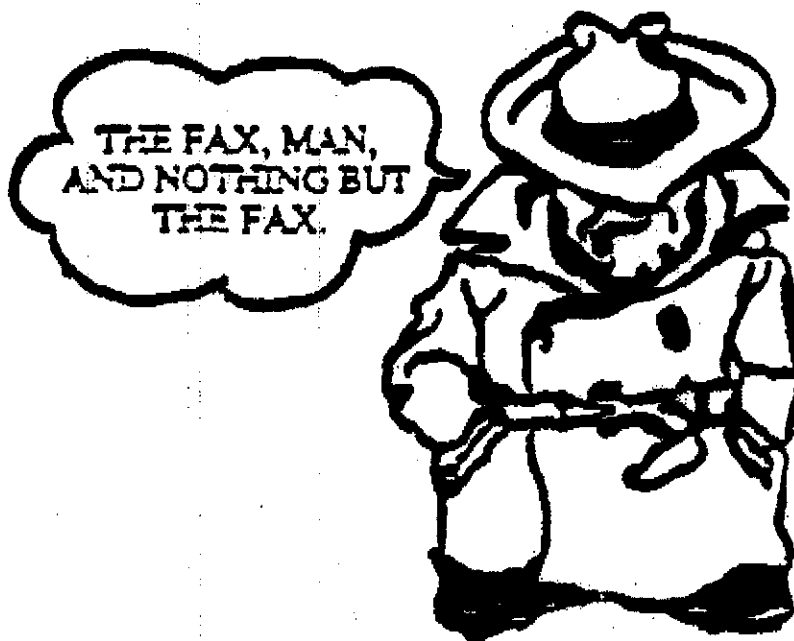
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IF THE FOLLOWING MESSAGE IS RECEIVED POORLY, PLEASE CALL JUDY SOPHIANOPOLUS
IN OUR OFFICE AT (404) 347-3555, x6408

SPECIAL NOTES OR INSTRUCTIONS: KEVIN, WOULD YOU PLEASE FAX YOUR
COMMENTS ON VCC TV APPLICATION TO ME AND TO STEVE
BOSWELL? THANK YOU.






UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

APR 24 1995

6 PAGES

VIA FACSIMILE TRANSMISSION

FROM: (404) 347-5205

TO: (601) 636-5767

4WD-RCRA

Mr. Steven T. Boswell
Director of Environmental Affairs
Vicksburg Chemical Company
Post Office Box 821003
Vicksburg, Mississippi 39182

SUBJ: Application for a Temporary Unit, Pursuant to
40 CFR Subpart S, by Vicksburg Chemical Company,
MSD 990 714 081, to Evaluate Use of Bioremediation for
Corrective Action Required under Consent Decree,
Civil Number W92-0008(B): EPA Review and Comments

Dear Mr. Boswell:

The U.S. Environmental Protection Agency (EPA), Region 4,
has completed a review of the application referenced above, which
you submitted with a cover letter, dated March 31, 1995.
Enclosed please find comments based on that review.

The comments are listed in tabular form in the enclosure,
and the majority of the comments are editorial in nature.

A copy of the comments is being faxed to Kevin Posey,
Mississippi Department of Environmental Quality (MSDEQ), along
with a request that MSDEQ comments be faxed to you and to EPA.

If you have any questions concerning the comments, please
contact me at (404) 347-3555, x6408.

Sincerely yours,

Judy Sophianopoulos
Project Coordinator
AL/MS Unit
RCRA Compliance Section

Enclosure

Printed on Recycled Paper

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AL/MS Unit
RCRA Compliance Section

Enclosure

J. Sophianopoulos/4WD-RCRA:7603/04-24-95/Boswell.fax on Disk
Soph042095

RECOMMENDED CHANGES					
Section Number	Page Number	Paragraph Number	Line Number	Currently Reads	Should Read and/or Comment
2.0 & Fig.3	5 & Fig. 3	2	2	"removable roof"	Fig. 3 states that roof is bolted to concrete; need to clarify how the roof can be removed.
3	6	1	1	"The... compounds:"	Insert as line 1 a sentence stating the location(s), including SWMU #s, from which the waste to be biotreated will be taken.
3.3	6	1	Bullet # 3	"(MSMA)"	Need to indicate that arsenic is not biodegradable; perhaps list separately biodegradable constituents of concern.
3.4	7	The Table	The Table	"...80 ...16,000"	Just before, or just after the table, include a sentence stating the source of the values, that they are based on ingestion, and that carcinogenicity of arsenic was not accounted for. You may also need to consider soil concentrations that are protective of groundwater.

RECOMMENDED CHANGES					
Section Number	Page Number	Paragraph Number	Line Number	Currently Reads	Should Read and/or Comment
3.4	7	The Table	The Table	"...80 ...16,000"	Just after the table, include a sentence stating how you will sample and analyze to verify that biotreatment has occurred, and to what extent. Also indicate how you will determine that no toxic products and/or emissions are produced by microbial action. You may need to consult the vendors for the projects in Louisiana and Arkansas, which are the basis of the decision to try bioremediation.
4.1	9	1	2	"The... monitored."	Include the identification numbers of the monitoring wells that could detect releases from the temporary unit.
REMAINING RECOMMENDED CHANGES ARE FOR APPENDIX A: DRAFT PREINVESTIGATION EVALUATION OF CORRECTIVE MEASURES TECHNOLOGIES					
3.2	4	1	4	"...type of contami- nant and it concentra- tions, and desired..."	"...types of contami- nants and their concentra- tions and desired..."

RECOMMENDED CHANGES					
Section Number	Page Number	Paragraph Number	Line Number	Currently Reads	Should Read and/or Comment
3.5	4	1	3	"...impact of..."	"...impact on..."
3.5	4 - 5	1	4 on page 4 thru 3 on page 5	"Air... system."	"Air stripping of groundwater must meet requirements of RCRA, the Clean Air Act, and all local air emission standards. Air pollution control equipment, such as a vapor-phase adsorption system, may be required."
3.6	5	1	2,3	"...UV-catalyzed oxidation. ..."	"...oxidation in the presence of ultraviolet (UV) light..."
3.7	5	1	3	"The... perpetuity."	How does one insure that the site will never become residential?
4.1.1	8	3	4	"...manufactures..."	"...manufactured..."
4.3.1	20	3	2	"...groundwater event at..."	"...groundwater even at..."
4.3.4	23	2	2	"...produced..."	"...produces..."
4.3.4	24	3	6,7	"Highly... treatment."	Need to indicate that Land Disposal Restrictions (LDR) may be applicable to systems with equalization basins.

					list of acronyms and abbreviations as a separate page before Section 1.
4.3.4	25	3	5	"...applied the surface..."	"...applied to the surface..."
4.3.6	29	1,2	All	"Distillation... technique."	Delete lines 1 and 2 of the first paragraph, and exchange paragraphs 1 and 2, so that paragraph 2 becomes paragraph 1 and the edited paragraph 1 becomes paragraph 2.
4.3.6	29	Last	Last	"...minimum boilup..."	Add a sentence which defines "boilup."
4.3.6	30	1	3	"...of the ration..."	"...or the ratio..."

Dr. Judy Sophianopoulos
RCRA and FF Office
United States Environmental Protection Agency, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

March 31, 1995

Re: Cedar Chemical Company RFI
Consent Decree Civil Number W92-0008B
Request for a Temporary Unit

Dear Dr. Sophianopoulos:

As we discussed by telephone, Friday, March 31, please find enclosed with this letter a request to establish a Temporary Unit at the Vicksburg Chemical site in Vicksburg, MS. Vicksburg has reason to believe that bio-remediation of the pesticide contaminants found at this site may be possible, at least in some areas. Work done at other sites (in Louisiana and Arkansas) contaminated by toxaphene and dinoseb indicates that a composting technique is both rapid and effective in destroying these constituents. Before going into a large scale program, it would seem prudent to try a scale-up test that is larger than bench-scale but still small enough to dispose of off-site at a later date if the test should be unsuccessful.

The information required (by 40 CFR 264.553) for the request is described in the enclosed material. Vicksburg envisions operating two or three tests simultaneously in order to get information on what mixing ratios are needed to balance speed of treatment and economy. We anticipate requesting the establishment of one or more Corrective Action Management Units at a later date to facilitate management of these wastes and other wastes during the RFI process.

Also, as we briefly discussed, Vicksburg wishes to cease collecting accumulated rainwater from certain areas in which tanks and equipment were located in the past. The areas to be considered are the "Tank Farm" containments located in the South Plant that in years past held raw materials and products from the manufacture of dinoseb and toxaphene. All the tanks and associated equipment have been removed. The interior of these areas are contaminated to some degree, but as you observed during your visit in January, the surrounding ground is also stained. Vicksburg proposes to open the walls of these containments to allow rainwater to drain from them. The drainage will find its way into the South Pond as does other rain falling on the area.

The Potassium People

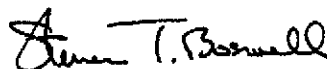
P.O. Box 821003 • Vicksburg, MS 39182
Bus: (601) 636-1231 • Fax: (601) 636-5767

Obviously, the containments we propose to use as a Temporary Unit will not receive this treatment. No other area is proposed to be opened for drainage (particularly SWMU #1 as it would not drain to the South Pond.)

Included with the request for a Temporary Unit is a draft version of the Preliminary Evaluation of Corrective Measures Technologies required by the Scopes of Work under the Decree. We have included this information for reference although its final form may change when submitted as one of the deliverable items.

Please advise Vicksburg Chemical of your decision regarding these requests. Copies will also be sent to MSDEQ for their review. Thank you for your consideration of this matter. Please contact me with any questions there may be.

Sincerely,



Steven T. Boswell
Director of Env. Affairs

STB: pc

xc: Mr. Miles
Mr. Madsen
Mr. Posey, MSDEQ
Mr. Karkkainen, Woodward-Clyde



Mr. Kevin Posey
Env. Engineer
Office of Pollution Control
P.O. Box 10385
Jackson, MS 39289-0385

RECEIVED
APR - 3 1995
Dept. of Environmental Quality
Office of Pollution Control

March 31, 1995

Re: Vicksburg Chemical Company
MSD990714081
RFI and Civil No. W92-0008B
Request for a Temporary Unit

Dear Mr. Posey:

Please find enclosed a copy of a request for a Temporary Unit to be created at the Vicksburg facility as was briefly discussed earlier this month with David Peacock and you. A copy of the letter sent to Judy Sophianopoulos is enclosed. Please contact me with any questions there may be.

Sincerely,

A handwritten signature in black ink, appearing to read "Steven T. Boswell".

Steven T. Boswell
Director of Env. Affairs

STB: pc

xc: Mr. Miles
Mr. Madsen
Dr. Judy Sophianopoulos

The Potassium People

P.O. Box 821003 • Vicksburg, MS 39182
Bus: (601) 636-1231 • Fax: (601) 636-5767

REQUEST FOR TEMPORARY UNIT

**VICKSBURG CHEMICAL COMPANY
CEDAR CHEMICAL CORPORATION**

Prepared for
Vicksburg Chemical Company
Vicksburg, Mississippi

Cedar Chemical Corporation
Memphis, Tennessee

March 1995

WCC File 92B007C

Woodward-Clyde 

Woodward-Clyde Consultants
2822 O'Neal Lane (70816)
P.O. Box 66317 (70896)
Baton Rouge, Louisiana

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INTRODUCTION

Vicksburg Chemical Company (VCC) has retained Woodward-Clyde Consultants (WCC) to perform activities associated with a RCRA corrective action program. The corrective action program is in response to a Consent Decree, Civil Number W92-0008(B). The Consent Decree requires that a RCRA Facility Investigation (RFI) be conducted at the Vicksburg, Mississippi manufacturing facility and that a closure plan be prepared for SWMU 1 - Hazardous Waste Container Storage Area and SWMU 17 - Off-Specification Product Storage Area.

The purpose of the RFI is to determine the nature and extent of releases of hazardous wastes and/or constituents from regulated units, solid waste management units (SWMUs), and other areas of concern (AOCs) at the facility and to gather all necessary data to support a Corrective Measures Study.

The RFI constitutes the second phase of the RCRA corrective action program. The program's initial phase consists of the RCRA Facility Assessment (RFA) which is conducted by EPA and precedes the RFI. The RFI itself is divided into five separate tasks which includes the Preliminary Report (submitted as a separate document in May 1992 and resubmitted as the Amended and Restated Preliminary Report in February 1994), the RFI Work Plan, the Facility Investigation, and the Investigative Analysis and Reports. In addition to these phases, a Groundwater Assessment Work Plan and Annual Groundwater Assessment Reports are required by the Consent Decree.

As part of the RFI/CMS process, VCC has prepared a Draft Preinvestigation Evaluation of Corrective Measures Technologies (PECMT) report which is a listing of technologies that may be utilized as corrective measures for the remediation of Solid Waste Management Units (SWMUs) and Area of Concern (AOC). The PECMT is a deliverable, due to the U.S. EPA and Mississippi Department of Environmental Quality (MSDEQ) 60 days after approval of the RFI Preliminary Report. As part of the technology investigation process, VCC has conducted laboratory scale tests on biodegradation of the contaminants of concern in soils and other solid media such as

concrete at the VCC site. The results of the tests are sufficiently promising that VCC wishes to proceed with pilot scale testing. This report is a Request for Temporary Unit pursuant to 40 CFR 264.553. The draft PECMT is attached as Appendix A.

This Request for a Temporary Unit contains the following information:

- **Operational Factors**
 - *length of time the unit will be in operation*
 - *type of unit*
 - *volumes of waste to be managed*
 - *physical and chemical characteristics of the wastes to be managed in the unit*
 - *potential for release from the unit*
- **Environmental Factors**
 - *hydrogeology of the site and other environmental conditions which may influence the migration of potential releases; and*
 - *potential for exposure of human and other environmental receptors if a release were to occur.*

This Request for a Temporary Unit also defines the activities to be executed by VCC pursuant to the establishment of a Temporary Unit and conduct of pilot plant activities.

1.1 DESCRIPTION OF THE SOUTH PLANT

The contaminated soil and concrete and the proposed location of the Temporary Unit are located within the South Plant of Vicksburg Chemical Company. Vicksburg Chemical Company is located in Warren County, Mississippi along the Mississippi River within the south section of the City of Vicksburg (see Figure 1). The address is:

Vicksburg Chemical Company
Post Office Box 821003
Rifle Range Road
Vicksburg, Mississippi 39182

The facility is a manufacturer of chemicals. The plant site is divided physically and functionally into a "north plant" and a "south plant". The north plant is primarily a manufacturer of potassium nitrate, chlorine and nitrogen tetroxide. The south plant formerly manufactured pesticides and herbicides. The south plant presently manufactures nitric acid, which is used primarily as a raw material in the north plant, and potassium carbonate (K-Carb). Some nitric acid and all the K-Carb is sold commercially.

The south plant formerly contained the manufacturing operations for production of the following products:

- Cyanazine
- Methyl parathion
- Atrazine
- Toxaphene
- Dinitrobutyl phenol (dinoseb)
- Monosodium methane arsenate
- Di Ethylhexyl Phosphoric Acid

1.2 HISTORY OF THE SOUTH PLANT

All pesticide plants were shut down by 1986 and have been dismantled. Any non-de minimis spills from toxaphene would have been handled as a hazardous waste (P123). The monosodium methane arsenate (MSMA) plant generated listed RCRA waste K031, a by-product salt. The by-product salt cake was directly discharged into a "roll-off sludge container". When the container was full (2 to 4 days) it was transported by a hazardous waste transporter to a hazardous waste landfill. The MSMA plant was designed such that there was intended to be no effluent with all spills, etc., retained and recycled to the process.

The dinitrobutyl phenol (Dinoseb) plant produced process wastewater that was hazardous by virtue of characteristic (D002). The waste was pumped to 1 to 3 day storage and was transported by a hazardous waste transporter to off-site disposal by hazardous waste deep well injection. At times the manufactured process wastewater was neutralized with ammonia and pumped to a 1.6 million gallon storage tank. After

neutralization, the water did not exhibit the characteristic of a hazardous waste and was pumped through activated carbon prior to discharge to the surface impoundment.

The SWMUs and AOCs within the south and north plant are noted on Figure 1. History and a discussion for existing data for each of the SWMUs and AOCs has been provided in detail to the U.S. EPA and MSDEQ in the Amended and Supplemental Preliminary Report submitted in February 1994. The need by VCC to utilize existing warehouse areas has resulted in investigation and corrective action at SWMU 9 the Former Dinoseb Drumming and Storage Area and SWMU 16 the Former Atrazine Production Storage Area. The investigation work plan was submitted to the U.S. EPA and MSDEQ in August 1994 and the report of finding was submitted in October 1994. Part of the corrective action was to grind the surface of concrete to allow a satisfactory bond for a concrete overlay.

The concrete grindings are contaminated and have been used as a source to test biotreatment in the laboratory as a means of destroying the contaminants. Additionally various soil areas, identified as SWMU's within the production areas of the South plant, are contaminated. The extent of the contamination is yet to be defined but there is sufficient information to establish that technology for corrective action needs to be more clearly defined.

LOCATION AND PHYSICAL DESCRIPTION OF TEMPORARY UNIT

There are two open top concrete structures adjacent to SWMU 7 and SWMU 20 that are to comprise the Temporary Unit. The structures are noted in Figure 2. The structures were formerly secondary containment structures for tanks of pesticide intermediates and formulations. The tanks have been removed. Each of the concrete structures is approximately 5 feet by 23.5 feet by 70 feet and contains one inner partition.

Prior to being put in service as a Temporary Unit, cracks and holes within the concrete would be patched or caulked. A removable roof would be constructed atop the concrete structure in order to avoid rainfall from entering the structure. A typical construction detail is provided as Figure 3. The roofs will be constructed of corrugated fiberglass with a fiberglass ridge cap and lifting lugs. Additionally, the reactors would be fitted with 2-inch PVC pipe that reaches to the bottom in order to allow water to be withdrawn, if necessary. Another 2-inch PVC pipe would reach to the bottom and would be fitted with a piece of slotted PVC pipe to allow air to be sparged through the reactor, if required.

TEMPORARY UNIT-OPERATIONAL FACTORS

3.1 LABORATORY OBSERVATIONS

The Temporary Units will be operated as aboveground biological reactors. The conditions in the laboratory that will be simulated but not duplicated are as follows:

- Reactor - stoppered bottle - anaerobic conditions
- Media - water slurry
- Nutrients - 5 percent sugar; 1 percent ammonium phosphate
- Starter bacteria - raw influent to city of Vicksburg sewage plant
- Temperature - 88° F
- Time for greater than 90 percent reduction - 3 weeks

3.2 PILOT PLANT - TYPE OF UNIT

The pilot plant reactor will not be a mixed slurry run under anaerobic conditions, but rather will be a anaerobic composting reactor. Each concrete structure will be filled with contaminated soil and/or concrete grindings and composting material supplied by Bioremediation Technology Service, Incorporated of Sanora, California. There are two concrete structures with one partition in each, so that the ratio of composting material to contaminated media might include 1 to 1, 1 to 1.5, 1 to 2 and 1 to 2.5.

3.3 PHYSICAL AND CHEMICAL CHARACTERISTICS OF WASTE TO BE MANAGED IN THE UNIT

The contaminants of concern within the mixture of compost, soil and/or concrete grindings will be the following compounds:

- Toxaphene
- Dinitrobutyl phenol (dinoseb)
- Monosodium Methane Arsenate (MSMA)

- Atrazine
- Toluene

Concentrations of the individual constituents when mixed with the compost will generally not exceed 1,000 to 2,000 parts per million.

The finished product of the compost and soil will physically resemble gardening mulch. Those mixtures that contain concrete grindings will probably resemble gardening mulch mixed with sand.

3.4 LENGTH OF TIME THE UNIT WILL BE IN OPERATION

The Request for a Temporary Unit assumes an operational period of 1 year. Time of operation for each batch within the Temporary Unit is a major variable. The degradation of constituents will be followed versus time. The objective will be to reduce concentrations of constituents of concern to levels below the following:

Constituent	Concentration (mg/kg)
Dinoseb	80
Arsenic	24
Toxaphene	2.6
Atrazine	400
Toluene	16,000

3.5 VOLUME OF WASTE TO BE MANAGED

Initially as much as 250 cubic yards of contaminated soil and/or concrete grindings will be mixed with 125 to 200 cubic yards of composting material. Ammonium phosphate may be added as a nutrient. Assuming the batch time averages 3 months, as much as 1,000 cubic yards of waste could be treated in the Temporary Unit.

§ 264.553 Temporary Units (TU).

(a) For temporary tanks and container storage areas used for treatment or storage of hazardous remediation wastes, during remedial activities required under § 264.101 or RCRA section 3008(b), the Regional Administrator may determine that a design, operating, or closure standard applicable to such units may be replaced by alternative requirements which are protective of human health and the environment.

(b) Any temporary unit to which alternative requirements are applied in accordance with paragraph (a) of this section shall be:

- (1) Located within the facility boundary; and
- (2) Used only for treatment or storage of remediation wastes.

(c) In establishing standards to be applied to a temporary unit, the Regional Administrator shall consider the following factors:

- (1) Length of time such unit will be in operation;
- (2) Type of unit;
- (3) Volumes of wastes to be managed;
- (4) Physical and chemical characteristics of the wastes to be managed in the unit;
- (5) Potential for releases from the unit;
- (6) Hydrogeological and other relevant environmental conditions at the facility which may influence the migration of any potential releases; and
- (7) Potential for exposure of humans and environmental receptors if releases were to occur from the unit.

(d) The Regional Administrator shall specify in the permit or order the length of time a temporary unit will be allowed to operate, to be no longer than a period of one year. The Regional Administrator shall also specify the design, operating, and closure requirements for the unit.

(e) The Regional Administrator may extend the operational period of a temporary unit once for no longer than a period of one year beyond that originally specified in the permit or order, if the Administrator determines that:

- (1) Continued operation of the unit will not pose a threat to human health and the environment; and
- (2) Continued operation of the unit is necessary to ensure timely and efficient implementation of remedial actions at the facility.

(f) Incorporation of a temporary unit or a time extension for a temporary unit into an existing permit shall be:

- (1) Approved in accordance with the procedures for Agency-initiated permit modifications under § 270.41; or
- (2) Requested by the owner/operator as a Class II modification according to the procedures under § 270.42 of this chapter.

(g) The Regional Administrator shall document the rationale for designating a temporary unit and for granting time extensions for temporary units and shall make such documentation available to the public.

OSWER
1768

Subpart S – Corrective Action for Solid Waste Management Units

Source: 58 FR 8683, Feb. 16, 1993, unless otherwise noted.

§ 264.552 Corrective Action Management Units (CAMU).

(a) For the purpose of implementing remedies under § 264.101 or RCRA Section 3008(h), the Regional Administrator may designate an area at the facility as a corrective action management unit, as defined in § 260.10, in accordance with the requirements of this section. One or more CAMUs may be designated at a facility.

(1) Placement of remediation wastes into or within a CAMU does not constitute land disposal of hazardous wastes.

(2) Consolidation or placement of remediation wastes into or within a CAMU does not constitute creation of a unit subject to minimum technology requirements.

(b)(1) The Regional Administrator may designate a regulated unit (as defined in § 264.90(a)(2)) as a CAMU, or may incorporate a regulated unit into a CAMU, if:

(i) The regulated unit is closed or closing, meaning it has begun the closure process under § 264.113 or § 265.113; and

(ii) Inclusion of the regulated unit will enhance implementation of effective, protective and reliable remedial actions for the facility.

(2) The subpart F, G, and H requirements and the unit-specific requirements of part 264 or 265 that applied to that regulated unit will continue to apply to that portion of the CAMU after incorporation into the CAMU.

(c) The Regional Administrator shall designate a CAMU in accordance with the following:

(1) The CAMU shall facilitate the implementation of reliable, effective, protective, and cost-effective remedies;

(2) Waste management activities associated with the CAMU shall not create unacceptable risks to humans or to the environment resulting from exposure to hazardous wastes or hazardous constituents;

(3) The CAMU shall include uncontaminated areas of the facility, only if including such areas for the purpose of managing remediation waste is more protective than management of such wastes at contaminated areas of the facility;

(4) Areas within the CAMU, where wastes remain in place after closure of the CAMU, shall be managed and contained so as to minimize future releases, to the extent practicable;

(5) The CAMU shall expedite the timing of remedial activity implementation, when appropriate and practicable;

(6) The CAMU shall enable the use, when appropriate, of treatment technologies (including innovative technologies) to enhance the long-term effectiveness of remedial actions by reducing the toxicity, mobility, or volume of wastes that will remain in place after closure of the CAMU; and

(7) The CAMU shall, to the extent practicable, minimize the land area of the facility upon which wastes will remain in place after closure of the CAMU.

(d) The owner/operator shall provide sufficient information to enable the Regional Administrator to designate a CAMU in accordance with the criteria in § 264.552.

(e) The Regional Administrator shall specify, in the permit or order, requirements for CAMUs to include the following:

(1) The areal configuration of the CAMU.

(2) Requirements for remediation waste management to include the specification of applicable design, operation and closure requirements.

- (3) Requirements for ground water monitoring that are sufficient to:
- (i) Continue to detect and to characterize the nature, extent, concentration, direction, and movement of existing releases of hazardous constituents in ground water from sources located within the CAMU; and
 - (ii) Detect and subsequently characterize releases of hazardous constituents to ground water that may occur from areas of the CAMU in which wastes will remain in place after closure of the CAMU.
- (4) Closure and post-closure requirements.
- (i) Closure of corrective action management units shall:
 - (A) Minimize the need for further maintenance; and
 - (B) Control, minimize, or eliminate, to the extent necessary to protect human health and the environment, for areas where wastes remain in place, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground, to surface waters, or to the atmosphere.
 - (ii) Requirements for closure of CAMUs shall include the following, as appropriate and as deemed necessary by the Regional Administrator for a given CAMU:
 - (A) Requirements for excavation, removal, treatment or containment of wastes;
 - (B) For areas in which wastes will remain after closure of the CAMU, requirements for capping of such areas; and
 - (C) Requirements for removal and decontamination of equipment, devices, and structures used in remediation waste management activities within the CAMU.
 - (iii) In establishing specific closure requirements for CAMUs under § 264.552(e), the Regional Administrator shall consider the following factors:
 - (A) CAMU characteristics;
 - (B) Volume of wastes which remain in place after closure;
 - (C) Potential for releases from the CAMU;
 - (D) Physical and chemical characteristics of the waste;
 - (E) Hydrological and other relevant environmental conditions at the facility which may influence the migration of any potential or actual releases; and
 - (F) Potential for exposure of humans and environmental receptors if releases were to occur from the CAMU.
 - (iv) Post-closure requirements as necessary to protect human health and the environment, to include, for areas where wastes will remain in place, monitoring and maintenance activities, and the frequency with which such activities shall be performed to ensure the integrity of any cap, final cover, or other containment system.
- (f) The Regional Administrator shall document the rationale for designating CAMUs and shall make such documentation available to the public.
- (g) Incorporation of a CAMU into an existing permit must be approved by the Regional Administrator according to the procedures for Agency-initiated permit modifications under § 270.41 of this chapter, or according to the permit modification procedures of § 270.42 of this chapter.
- (h) The designation of a CAMU does not change EPA's existing authority to address clean-up levels, media-specific points of compliance to be applied to remediation at a facility, or other remedy selection decisions.

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1768

3.6 POTENTIAL FOR RELEASE FROM THE UNIT

As noted in Section 2.0, cracks and holes in the concrete structures comprising the Temporary Unit will be patched and caulked. Additionally roofs will be constructed to avoid rainwater from entering the unit and potentially causing overflow of material. The greatest potential for release exists while loading and unloading the unit. Since the unit is in a SWMU area and would be loaded with material excavated or otherwise moved from nearby already contaminated, there is no incremental potential to release caused by the operation of the unit.

ENVIRONMENTAL FACTORS

Reference is made to the Amended and Supplemental Preliminary Report submitted to the U.S. EPA and MSDEQ in February 1994. Section 4.0, Environmental Setting; Section 5.0, Nature and Extent of Contamination; Section 6.0, Potential Release Pathways and Section 7.0, Exposure and Environmental Assessment are adopted by reference.

4.1 HYDROGEOLOGY

A potentiometric contour map is provided as Figure 4. Monitor well locations are also noted on Figure 4. The groundwater in the vicinity of the Temporary Unit is monitored. The incremental potentially adverse environmental effect of the Temporary Unit is non-existent. Contaminated material that has some potential for environmental release is to be excavated or otherwise moved into the Temporary Unit where there is a lesser potential for environmental release.

**4.2 POTENTIAL FOR HUMAN AND OTHER ENVIRONMENTAL RECEPTORS
IF A RELEASE WERE TO OCCUR**

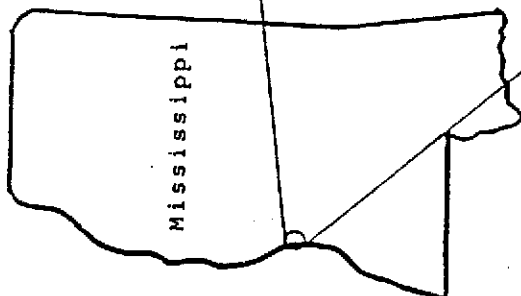
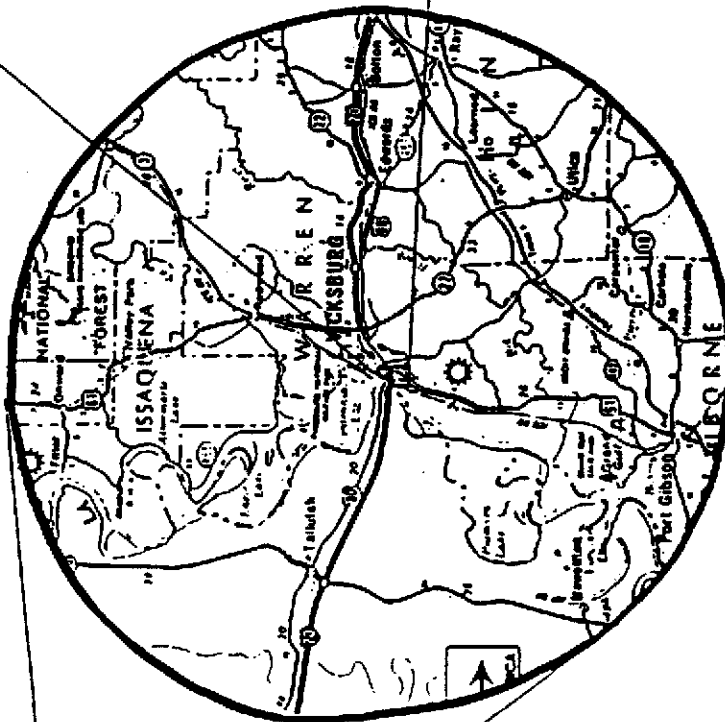
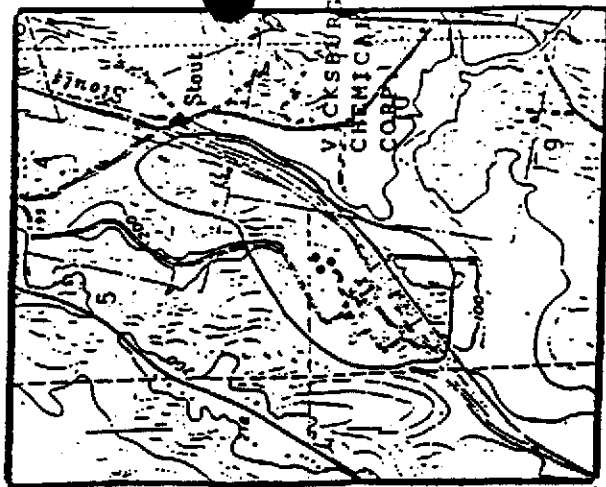
There is at present some potential for VCC workers to contact the contaminated materials. Additionally, there is some potential for release to the environment. The excavation or other movement of the materials into the Temporary Unit will reduce the potential for contact with human and other environmental receptors. The excavation or other movement of materials will be implemented by personnel with appropriate training under the auspices of a health and safety plan.

TEMPORARY UNIT CLOSURE

Temporary storage and ultimate disposition of material treated in the Temporary Unit will depend on the success of the treatment. The main objective of the pilot plant effort in the Temporary Unit is to help define the technology to be suggested in the Corrective Measure Study and later implemented. The Temporary Unit itself will be subject to the corrective action process; therefore, it is at present premature to select the method of closure.

FIGURES





VICKSBURG CHEMICAL CORP
 VICKSBURG CHEMICAL
 DIVISION
 VICKSBURG, MISSISSIPPI

Woodward-Clyde Consultants

Consulting Engineers, Geologists
 and Environmental Scientists
 Baton Rouge Louisiana

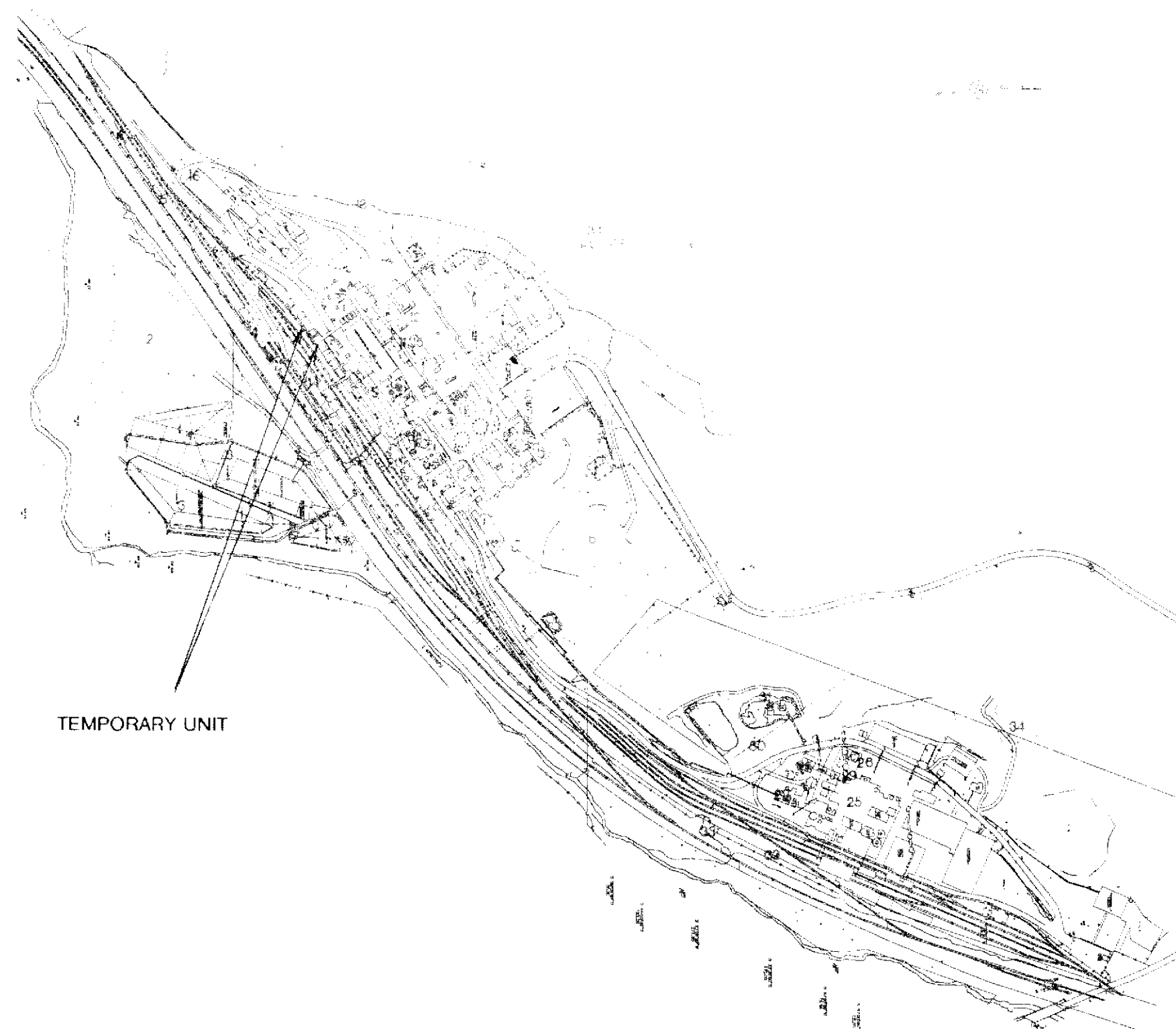


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	CHKD BY: <i>ROK</i>	DATE: 3-15-95

FACILITY LOCATION MAP

FILE NO
 92B007C

FIG NO
 1



TEMPORARY UNIT

SWMU NUMBER SOUTH PLANT

- 1 CONTAINER (DRUM) STORAGE AREA
- 2 VACANT LANDFILL
- 3 SURFACE W/STORAGE (SOUTH PLANT)
- 4 ACTIVATED CARBON TREATMENT UNITS
- 5 SOUTH PLANT DRAINAGE SYSTEMS
- 6 WASTEWATER STORAGE (HILL) TANKS
- 7 FORMER DIOSOLER PRODUCTION AREA
- 8 FORMER LOADING/UNLOADING AREA
- 9 FORMER TRUMMING AREA
- 10 FORMER MEVA PRODUCTION AREA
- 11 FORMER MEVA SALT UNLOADING AREA
- 12 SOUTH PLANT DRAINAGE LITCHES
- 13 FORMER TONAR LINE PRODUCTION AREA
- 14 FORMER MTAL PARATHION PRODUCTION AREA
- 15 FORMER ATHAZINE PRODUCTION AREA
- 16 RETURNED PRODUCT STORAGE AREA
- 17 FORMER ILLU TANK AREA
- 18 RAILROAD CAR UNLOADING STATION

NORTH PLANT

- 22 NORTH PLANT NEUTRALIZATION SYSTEM
- 23 EQUALIZATION/NEUTRALIZATION TANKS (NORTH PLANT)
- 24 NORTH PLANT WASTEWATER PIPES
- 25 OIL COLLECTION JUNK
- 26 NORTH PLANT WASTE OIL ACCUMULATION AREA
- 27 NO. 6 FUEL OIL AREA
- 28 NORTH PLANT DRAINAGE DITCHES

BOTH PLANTS

- 34 SURPLUS EQUIPMENT STORAGE (JUNKYARD)

AOC NUMBER AOC NAME

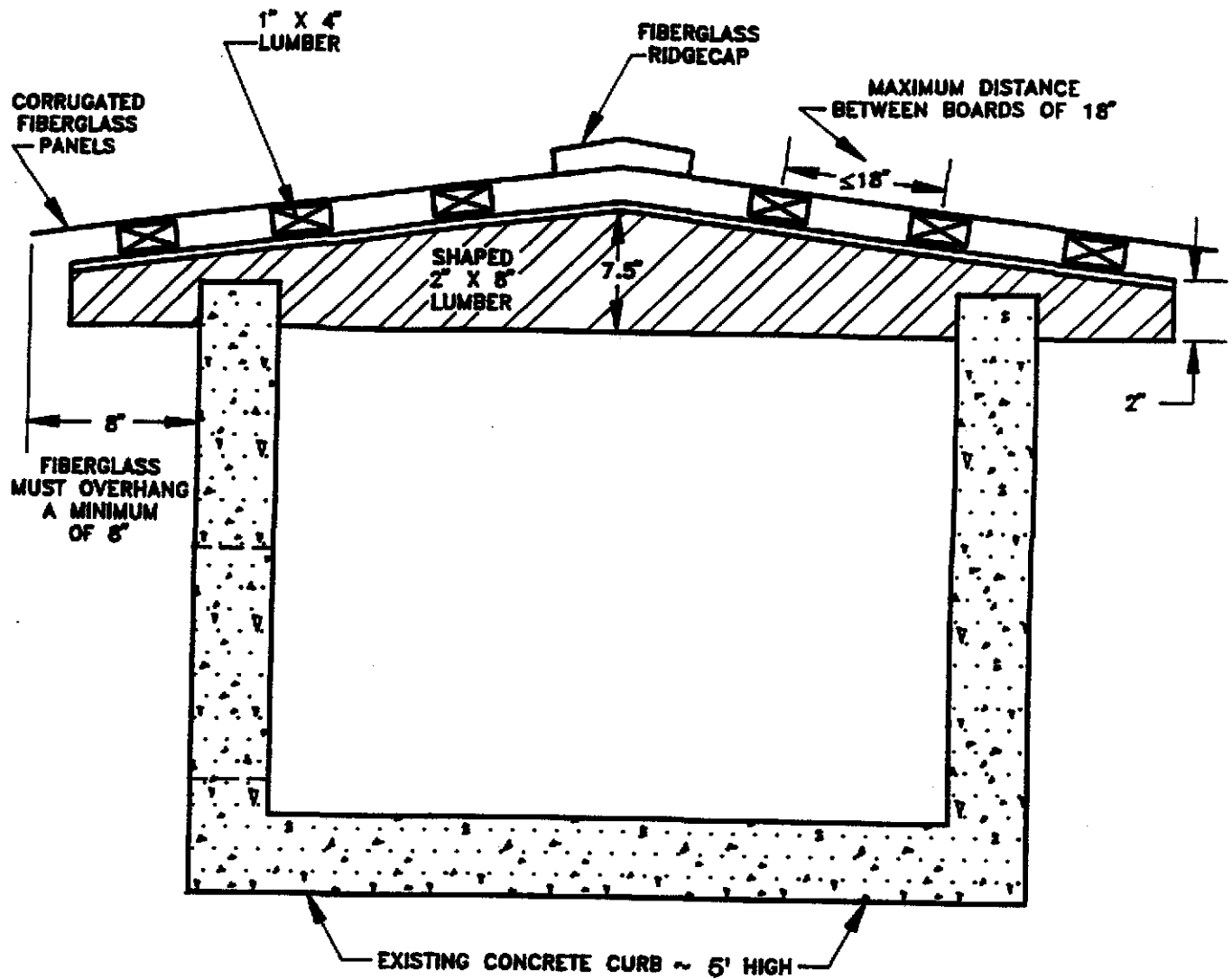
- 1 FISH POND (NORTH PLANT)
- 2 DRUM STORAGE AREA
- 3 NEUTRALIZATION TANKS (SOUTH PLANT)
- 4 CHEMICAL CRYPT (SEPTIC TANKS)



REQUEST FOR TEMPORARY UNIT			
WOODWARD-CLYDE CONSULTANTS Consulting Engineers, Geologists and Environmental Scientists Baton Rouge, Louisiana			
CEDAR CHEMICAL CORPORATION VICKSBURG CHEMICAL DIVISION VICKSBURG, MISSISSIPPI			
STATE	MADE BY GT	DATE 4/6/92	FIGURE NO
1"=200'	CHECKED BY	DATE	92B007C
LOCATION OF SOLID WASTE MANAGEMENT UNITS			2

NO.	REVISION	DATE	INITIAL

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NOTES:

- . ROOF BOLTED TO CONCRETE
- . ROOF FITTED WITH LIFTING LUGS
- . TEMPORARY UNIT IS TO BE FITTED WITH A MINIMUM OF TWO 2" PIPES PER CELL.
ONE PIPE IS SOLID FOR WITHDRAWAL OF WATER
ANOTHER PIPE IS FITTED WITH A SLOTTED PIECE FOR AIR SPARGING

**CUT AWAY VIEW
NOT TO SCALE**

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**CEDAR CHEMICAL CORPORATION
VICKSBURG CHEMICAL
VICKSBURG, MISSISSIPPI**

Woodward-Clyde Consultants
Consulting Engineers, Geologists
and Environmental Scientists
Baton Rouge, Louisiana

SCALE:
N.T.S.

DRAWN BY: J. BICKFORD
CHKD. BY: ROR

DATE: 6/15/92
DATE: 3/16/95

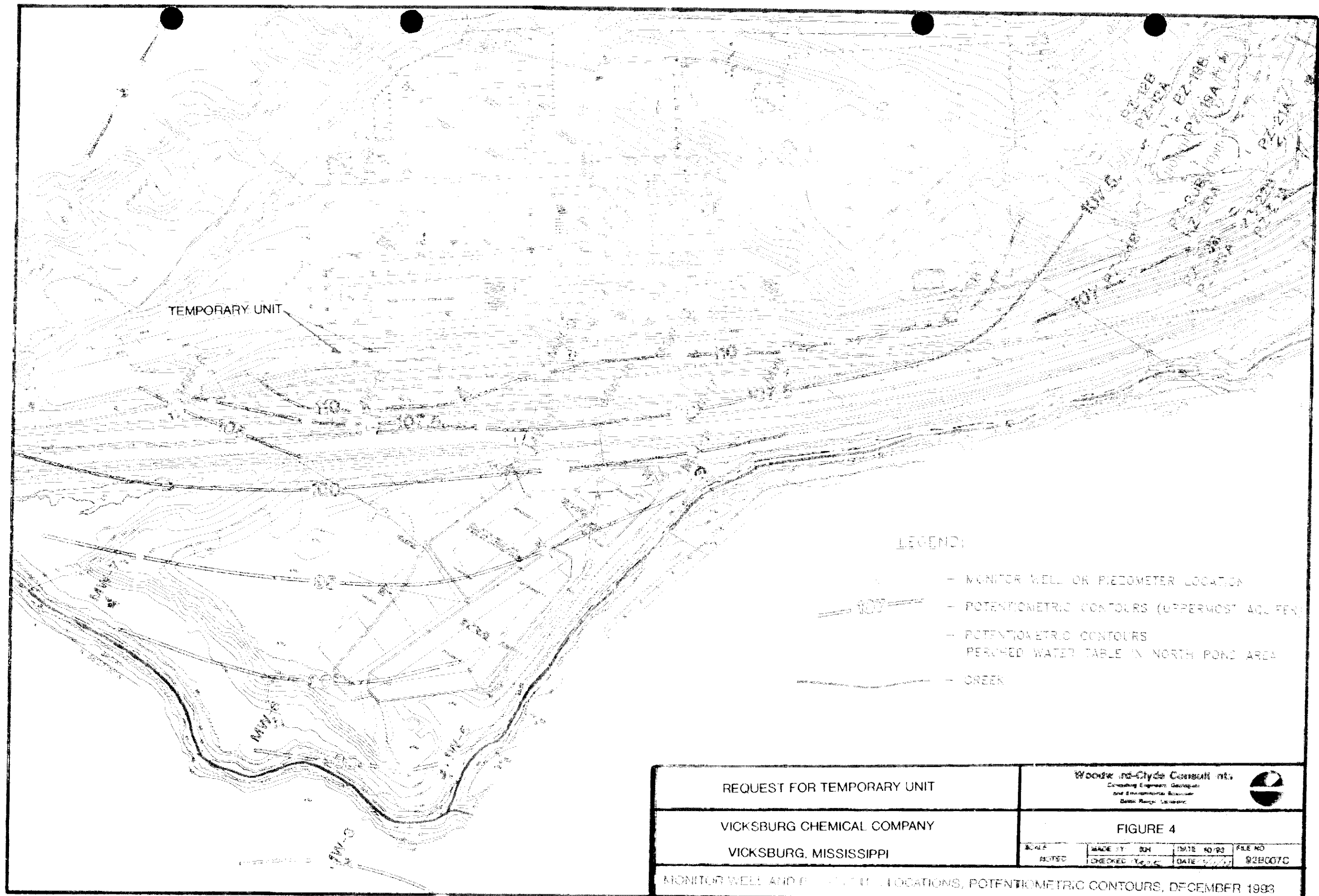
**TEMPORARY UNIT
TYPICAL CONSTRUCTION
DETAILS OF THE
ROOF COVER**

FILE NO

92B007

FIG. NO

3



APPENDIX A

**DRAFT PREINVESTIGATION - EVALUATION OF
CORRECTIVE MEASURES TECHNOLOGIES**

**APPENDIX A
DRAFT PREINVESTIGATION - EVALUATION
OF CORRECTIVE MEASURES TECHNOLOGIES**

**VICKSBURG CHEMICAL COMPANY
CEDAR CHEMICAL CORPORATION**

Prepared for
Vicksburg Chemical Company
Vicksburg, Mississippi

Cedar Chemical Corporation
Memphis, Tennessee

March 1995

WCC File 92B007C

Woodward-Clyde



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2822 O'Neal Lane (70816)
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INTRODUCTION

This Preinvestigation Evaluation of Corrective Measures Technologies (PECMT) report is a listing of technologies that may be utilized as corrective measures for the remediation of Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at Cedar Chemical Corporation's Facility in Vicksburg, Mississippi.

Cedar is conducting a RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) in response to a Consent Decree effective on Day 0. A work plan for the RFI activities has been submitted as a separate document. Concurrently with the RFI/CMS, Cedar is conducting certain Interim Measures (IM) and also a Groundwater Assessment (GWA). Separate work plans have been submitted for the IM and GWA. A summary of the initial submittals to the EPA and MSDEQ and other significant events are as follows:

Document or Event:

Submittal or Event Date:

Consent Decree Effective Date	Day 0
RFI Preliminary Report	Day 30
IM Work Plan	Day 30
Closure Plan for Container Management Area	Day 60
EPA Approval of RFI Preliminary Report	Day X
RFI Work Plan	X + 60 or less
GWA Work Plan	X + 60 or less
PECMT Report	X + 60 or less

OBJECTIVES

Solid Waste Management Units (SWMUs) and Areas of Concern (AOC) have been identified in the RCRA Facility Assessment, Consent Decree and RFI Preliminary Report. Implementation of the Interim Measures, RFI Field Investigation and Groundwater Assessment will yield definitive data on the contaminants and extent of contamination on soils and within the groundwater. Nevertheless there is sufficient existing data on the contaminants and range of concentrations expected to be found in soil and groundwater to be able to list technologies that are applicable to the site. Detailed discussions of existing data are found in the RFI Preliminary Report.

It is the objective of this report to identify potential corrective measures technologies that may be used on-site or off-site for the containment, treatment, remediation, and/or disposal of contamination. The emphasis will be on source control technologies. There may be ancillary pump and treat technology associated with source control, therefore, pump and treat technology will also be discussed. This report will also identify any field, laboratory, bench, or pilot scale data that needs to be collected during the RCRA facility investigation to facilitate the evaluation and selection of the final corrective measures (e.g., compatibility of waste and construction materials, information to evaluate effectiveness, treatability of wastes, etc.).

TECHNICAL CONSIDERATIONS FOR CLEANUP

This preinvestigation-evaluation concentrates on technologies available to meet requirements of Cedar at its Vicksburg Facility. Consideration is given to evaluating various remediation solutions that will satisfy federal and state cleanup standards. An analysis will be performed on those technologies during the conduct of a feasibility study to determine which technique will effectively remedy the problem and do so in a cost-effective manner. In this report, particular emphasis is placed on those technologies that offer remediation and cost-effective, on-site treatment.

A clear definition of the goals of a remedial action program along with an understanding of the site-specific parameters and the technical and economic limitations of the technologies under consideration will allow selection of the most effective treatment option. The site-specific chemical, geologic, and hydrogeologic parameters are subjects of the RFI Field Investigation. By consideration of those parameters along with the available technologies, specific recommendations for further work will be made during the feasibility study.

3.1 PROBLEM DEFINITION

No single treatment technology will be universally applicable for all corrective action. A thorough evaluation of all the site-specific parameters is necessary in order to select the most technically suitable and cost-effective treatment technology for the job. Because major corrective action programs, especially those involving source control and aquifer restorations, are likely to take several years to completely accomplish, the investment of time and effort to properly evaluate the site initially will more than pay for cost/benefit evaluation in the long run. The following generalized parameters are among those that should be defined.

3.2 CONTAMINANT COMPOSITION AND CONCENTRATION

Previous analysis of the site contamination has been made by Cedar, EPA, and MSDEQ. The level of contamination ranges from several hundreds of parts per million pesticides in the soil to parts per billion pesticides in the groundwater. With an understanding of the type of contaminant and its concentrations, and desired removal rates, technologies can be correctly applied. Technologies such as carbon adsorption and oxidation are dependent on concentrations and type of compound while technologies such as air stripping are more closely related to the treatment rate and desired removal efficiency.

3.3 DESIRED CLEANUP CRITERIA AND EFFLUENT DISPOSITION

Stringent cleanup criteria will eliminate some technologies from consideration because they will not meet the criteria within reasonable time frames. The ultimate disposition of the effluent or residues after treatment will have significant bearing on the treatment method.

3.4 VOLUME TO BE TREATED

Treatment volumes, defined by the horizontal and vertical extent of contamination, are not well defined at this point. A small volume may be best treated by a technology with low capital costs with possible high operating costs, while remediation of a larger magnitude is more likely to be accomplished utilizing an equally effective technology with lower operating costs. An evaluation of treatment options should include consideration of leasing equipment to treat small volume sources or purchasing equipment for treatment of large volume sources.

3.5 FATE OF TREATMENT BY-PRODUCTS

The disposition of treatment by-products must be considered in the choice of the treatment solution. Local requirements for disposition of treatment by-products will have a major impact on the viability and economics of various treatment technologies. Air stripping of groundwater can be an extremely effective technology if the organic-

laden air can be emitted directly to the environment; but in certain areas strict air emission standards may require that air stripping be followed by a vapor-phase adsorption system. Similar considerations exist with the generation of potentially toxic by-products from chemical oxidation process, or the possible need for nutrient removal (phosphorus and nitrogen) from the effluent of biological oxidation processes. The economics of using activated carbon adsorption is affected by the accessibility of an approved regeneration site for the contaminated carbon.

3.6 UTILITIES AVAILABILITY AND COST

The selection of certain technologies will be influenced by the availability of utilities, such as steam at the treatment site. Likewise, some processes such as UV-catalyzed oxidation can require a substantial resource of electrical power. The energy-intensive processes area also likely to be more attractive in certain parts of the country where electrical costs are less than in other regions.

3.7 LAND USE

At Cedar where normal production is ongoing, the operation of treatment systems or maintenance of closed facilities can be accomplished with the existing operations staff. The intention is that the Vicksburg site remain an industrial site in perpetuity.

3.8 IMPLEMENTATION TIME

The system to be used for remediation must be capable of being installed quickly enough to satisfy agency requirements.

3.9 EFFECTIVENESS

The proposed method and system for cleanup must accomplish containment of the source of contamination and effective removal of the contaminants that may be in the aquifer in a reasonable time.

3.10 LIMIT FUTURE LIABILITY

Cleanup must be accomplished in a way that will have minimal future liability for additional environmental remediation.

3.11 COST EFFECTIVENESS

A cleanup system should be selected that will accomplish the required remediation in the most cost-effective manner for both initial and long-term operations.

3.12 MINIMAL INTERFERENCE WITH NEIGHBORS

Installation and operation of the remediation system should cause minimum interference with the property and operations of adjacent property owners.

REMEDIAL ALTERNATIVES

The categories of remedial alternatives that are being considered in the preevaluation are as follows:

- **Groundwater Remediation**
 - Section 4.1 Containment Systems
 - Section 4.2 Hydraulic Control Systems
 - Section 4.3 Groundwater Treatment

- **Soil Remediation**
 - Section 4.4 Stabilization and Chemical Fixation
 - Section 4.5 Thermal Treatment
 - Section 4.6 Solvent Extraction
 - Section 4.7 Biological Degradation
 - Section 4.8 Off-site Disposal

The actual remediation for each SWMU or AOC may be a combination of the above. Specific technologies within the categories are discussed below.

4.1 GROUNDWATER REMEDIATION - CONTAINMENT SYSTEMS

Zones of contaminated groundwater may be contained by various barrier systems or hydraulic control systems. Barriers control the vertical inflow of surface water or groundwater through the contaminated soil zone. Surface caps, grading, vegetation, diversions, and collection systems can be used for control, containment, or collection of surface water. These technologies prevent run-on, control vertical infiltration, prevent erosion, collect and transfer water for treatment, store and discharge treated water, and protect against flooding.

Containment barriers such as bentonite slurry walls, grout curtains, vibratory beams/asphalt walls, or steel sheet piles are vertical walls that prevent migration of contaminated water out of an area or prevent flow into an area. These types of containment barriers are utilized in soil layers that transmit water horizontally.

4.1.1 Surface Cap

A cap system provides a mechanism for surface water runoff control. This eliminates contact of the wastes with air and minimizes infiltration/leaching of the rainfall which consequently controls the risk of contamination or further contamination of the near-source subsurface soils, rock and/or groundwater.

A cap prevents direct contact with any waste which may be left on site. Should all the waste be removed or treated to render it nonhazardous and immobile, then a cap system would not be necessary. Core component materials used in the construction of a cap are relatively impermeable to minimize infiltration and reduce the potential for contaminant migration to the groundwater; such materials may include synthetic membranes, compacted natural soils, cement or bituminous asphalt pavements, or chemical sealants/stabilizers.

Synthetic membranes are generally plastic/resin based materials which have low permeability compared to other materials. Membranes are typically made of butyl rubber, hypalon, PVC, ethylene, propylene diene monomer (EPDM), or high density polyethylene. The membranes are manufactured in sheets which require field installation to form a single cover for an area. The membranes may be subject to physical degradation and damage resulting from improper handling and installation.

A clay soil cap provides a natural low permeability barrier and is constructed using earth moving equipment to spread and compact the clay. Clay is not subject to appreciable physical deterioration and consequently is a durable long-term material. The clay is susceptible to cracking if exposed at the ground surface.

An asphalt cap is a more permeable barrier than the synthetic membrane. Asphalt is relatively flexible and, due to weathering and cracking, would require periodic long-term

repair. The asphalt could be applied as paving with a sealant, to provide a relatively thick, semi-permanent material.

Concrete is also more permeable than synthetic membranes and is susceptible to cracking. A concrete cap would require maintenance on a periodic basis.

Chemical sealants/stabilizers can provide permeability characteristics similar to that of the clay cap and in many cases are merely added to improve the sealant characteristics of on-site or imported clays. Adding lime to clay, for example, would reduce the shrink/swell properties if the clay were used without a cover.

A drainage zone of highly permeable material typically overlies the low permeability zone of the cap in order to enhance lateral drainage of infiltrating rainwater. A soil/vegetation zone is usually provided at ground surface to provide erosion stabilization by promoting vegetative cover without penetration of the cap by plant roots.

Synthetic membranes provide the least permeable barrier and consequently restrict the infiltration of rainfall but, left unprotected the membranes are subject to deterioration. A clay cap would be most durable if not exposed at the surface. The synthetic membrane augmented by the durability of natural clay cap may provide the optimum cap with the compacted clay overlain by the synthetic membrane. Protection of the synthetic membrane is also required. A free draining sand, with a vegetated soil cover, would serve a dual purpose of allowing storm water to run off more rapidly to site surface drainage channels, and prevent direct exposure of the membrane to the environment.

4.1.2 Grading, Diversion and Collection Systems

Grading of a site is performed to reduce the potential for erosion. Grading is reshaping of the contours of the existing ground surface to allow storm water runoff to drain without scouring away the topsoil, thereby protecting the cap and minimizing the potential for infiltration.

A number of technologies can be used for the control, containment or collection of surface water. Water exclusion measures include barriers and landscaping techniques. These technologies are designed to perform six basic functions; prevent run-on, control infiltration, prevent erosion, collect and transfer water for treatment, store and discharge treated water to a drainage ditch or sewer, and protect against flooding. A surface water management system may require a combination of technologies to minimize the production of leachate and prevent off-site contamination.

Dikes and berms are compacted earthen ridges designed to divert or retain surface water flow. They can be used to control flood water eliminating the potential for cap scour/erosion and also the potential for standing flood waters to infiltrate the cap. Also, control of runoff will reduce erosion potential.

Seepage basins and seepage ditches are used to discharge water collected from surface water diversions or groundwater pumping. Both types discharge collected water to the groundwater by allowing it to seep through the ground.

Channels are excavated ditches that are generally wide and shallow. Diversion channels are used primarily to intercept runoff or reduce drainage runs across slopes.

Terraces are embankments or combinations of embankments and channels constructed across a slope. Terraces can be used to intercept and divert surface flow away from a site to control erosion by reducing slope drainage runs.

Sedimentation basins are used to control suspended soiled particles in surface water flow. They can be part of the water treatment process, and their design will depend on that process and the amount of solids in the surface water.

Grading, diversion systems and collection system are an effective means of control, containment or collection of surface water and therefore and protective of cap barriers by means of minimizing the potential for erosion and infiltration.

4.1.3 Revegetation

Revegetation can perform several basic functions: it can stabilize soil and earthen structures against wind and water erosion by intercepting rainfall, slowing runoff, and holding soil together with a tight root system. Vegetation can reduce the quantities of water available for runoff through interception, infiltration, uptake and transpiration and can sometimes treat contaminated soil and leachate through the uptake and removal of waste constituents, nutrients, and water from soil.

Vegetation also can improve the aesthetic appearance of a site. Plants used for revegetation include various types of grasses, legumes, shrubs and trees. A vegetation program involves a careful plant selection, land preparation (such as increasing soil depth, grading, fertilizing and tilling), seeding and maintenance. As part of the selection process, consideration should be given to the remedial action implemented in conjunction with revegetation. For example, a cap would require a mix of grass such that it is covered throughout the year, whereas, a backfill could be revegetated with a lower maintenance cover.

Selection of vegetation will depend on site-specific requirements and plant characteristics. In general, grasses provide quick and lasting dense growth. They effectively anchor the soil, have high evapotranspiration characteristics, and may be suitable in wet areas such as waterways. They do, however, require periodic mowing and maintenance. Legumes, on the other hand, are a low maintenance cover providing long-term protection. They are most useful for stabilization and erosion control. They also have the added benefit of increasing the soil fertility through nitrogen fixation. Shrubs are useful in providing a dense surface cover and are tolerant to acidic soils. Trees are most suited for preparing a site for post-closure use.

4.1.4 Containment Barriers

Containment barriers are vertical walls installed to provide a more impermeable zone through a soil layer which transmits fluid horizontally. The two basic applications are to prevent migration of contaminated fluids out of the area defined by the barrier or prevent flow into the area enclosed by the barrier, primarily for dewatering purposes.

For the first application, the barrier is able to contain contaminated water in shallow aquifers to limit the extent of horizontal migration. Once containment by the barrier is established, contamination is either left in the groundwater and further isolated by placing a cap over the entire contained area, or a removal and treatment/disposal program is initiated to remove contaminated groundwater while minimizing the volume of groundwater requiring pumping. With the second application, the barrier may also function to reduce the dewatering requirements of excavations which extend beneath the water table to remove contaminated soil or wastes.

Containment barriers include the following:

- Soil bentonite slurry wall
- Cement bentonite slurry wall
- Grout curtains
- Vibratory beam/asphaltic wall.

A soil bentonite (SB) slurry wall is a method frequently utilized to contain hazardous waste migration. It involves excavating a 2 to 3 foot wide trench, extending beneath the contaminated zone to be cut off. The excavated soil (or clean import soil) is mixed with a bentonite slurry (also used in the trench to keep it open) and then pushed back into the trench. The SB slurry sets up as a flexible gel, which retards fluid flow. As a thick flexible wall, it will be adversely affected by ground movements associated with settlements or creep of subsurface formations. A permeability of 10^{-7} cm/second or less is usually achievable with a properly designed and constructed SB wall. Further, slurry walls may be constructed to function as "skimmer walls" to cut off movement of lighter than water constituents, or as full penetrating walls, keyed into a "bottom" formation which is itself a barrier to vertical movement of contaminated groundwater; this also affects the movement of heavier than water constituents.

A cement bentonite (CB) slurry wall is constructed by excavating a 2 to 3 foot trench and maintaining slurry in the trench. The slurry, a mixture of cement and bentonite, sets up as a more rigid wall than the SB was and consequently is frequently used around a deep excavation because it can be placed closer to the edge of the excavation without a resulting slope failure. A CB wall is more permeable than a SB wall and is also more

expensive. It is usually not possible to achieve a permeability significantly lower than 10^{-6} cm/second.

Grout Curtains can be constructed by pumping grout down into a permeable zone to seal off the contained area. The grout can be either a particulate or a chemical grout which fills the voids between the soil particles. Considerable control is required to ensure a water tight seal; placement of the curtain generally involve injections at a 4 to 8 foot spacing and possibly more than a single row of holes.

A vibratory beam wall is a thin (about 3 to 4 inches wide) asphaltic or cement bentonite mix wall which is installed by driving wide-flange H-section beams through the permeable zone. As the beam is withdrawn a void is created into which a relatively impermeable asphaltic or cement bentonite mix is injected. A wall is created by overlapping the sections. The cement bentonite mix will generally achieve a lower permeability of about 10^{-6} cm/second; the asphaltic mix can generally achieve a lower permeability. The vibrating beam wall is more subject to gaps than a soil bentonite wall. Because of its narrow width, it will also directly transmit more water than a soil bentonite wall. Its main advantage is in locations which do not have adequate space or stability for trenching, such as in areas where numerous subsurface pipelines or other subsurface obstacles are present.

4.2 GROUNDWATER REMEDIATION-HYDRAULIC CONTROL SYSTEMS

With hydraulic-control approaches, an aquifer is pumped in order to remove contaminated water, which is then disposed of off-site (with or without treatment) or reinjected on-site (after treatment). When one or more wells are used for hydraulic control, the wells must be located and constructed such that they (1) prevent the chemical plumes from escaping, i.e., reverse the flow of contaminated groundwater, and (2) recover the majority of the total mass of contaminants, which are usually concentrated near the center of the plume. With extensive plumes, many wells are required both to control the plume and to recover the water that is contaminated.

Hydraulic control with wells is a viable alternative for control and elimination of the chemical plumes in aquifers that have significant saturated thickness and are permeable.

In aquifers where saturated thickness of groundwater is only a few feet or where the sediments have low permeability, pumping wells have very small radii of influence.

Recovery trenches are excavated through the saturated zone to intercept the flow of groundwater or free phase contaminant and eliminate migration of chemicals past them. Recovery trenches are well suited to situations where the depth to groundwater and the saturated thickness are small. They become cost-prohibitive when depths are too great for excavation with standard equipment. Recovery trenches are also restricted when surface features, such as buildings, trees, or heavy paving, or subsurface features, such as large boulders, hard to excavate soils, or buried utilities, interfere with excavation.

4.2.1 Groundwater Pumping, Well Systems

Groundwater pumping can achieve the following:

- Gradient control or migration control in which the groundwater withdrawal establishes a hydraulic flow regime which eliminates or minimizes migration of contaminated groundwater to sensitive areas; and/or
- Contaminant removal, in which contaminated groundwater is pumped from the aquifer until the aquifer contamination reaches acceptable levels.

Groundwater pumping could be necessary depending on the assessment of risk of further horizontal and vertical migration of the contamination. Groundwater pumping for gradient control can be adequate for controlling horizontal migration but is generally not adequate where vertical migration is a major risk. Pumping for contaminant removal can be adequate control for both horizontal and vertical migration. Groundwater pumping may not be necessary if neither horizontal nor vertical migration presents a risk to public health or the environment.

Typical groundwater pumping scenarios are as follows:

- Pumping of the contaminated zone to control horizontal migration, remove contamination and reduce the risk of vertical migration; or
- Limited pumping of pressure relief wells within a barrier wall containment area to prevent possible rise in water levels within the contained area.

Groundwater pumping involves the following basis elements;

- Collection system (well)
 - Well points
 - Recovery wells
- Pumping system
- Recovered fluid handling system (storage, treatment, disposal).

Well Point collection systems consist of relatively closely spaced shallow wells connected to a central manifold suction lift system. Well points are usually small diameter (1.5 to 2 inch inside diameter) and are commonly installed by jetting techniques, or less commonly, by borehole drilling techniques.

Well point systems are subject to certain limitations including:

- Lift is limited to one atmosphere of pressure minus friction losses and system inefficiencies, usually the equivalent of about 25 feet or less.
- Drawdown within the well should not exceed the depth to the top of the well screen.

Use of the well point method often requires very close spacing of a large number of low pump rate wells. This technique is potentially applicable for remedial actions requiring gradient control along a limited perimeter of contamination. Contaminant removal over a large area would probably require a prohibitively large number of well points.

Recovery wells are generally drilled boreholes into which well screen, sand/gravel pack, well casing and borehole annulus seals have been placed. Well diameters of 4 inches or greater are generally used. Wells can be designed for recovery of dissolved phase contaminants, lighter than water free phase liquids, heavier than water free phase liquids, or a combination of different contaminant phases. With appropriate pumps recovery can be utilized in deep well systems.

Recovery rate, well spacing, and total number of wells required is primarily determined by hydrogeologic conditions. The main requirement is that sufficient flow rates are maintained to create a gradient toward the recovery wells.

Pumping systems for the recovery wells could include submersible pumps, jet pumps, positive displacement pumps or ejector pumps. Submersible pumps are generally better suited for deep, high yielding wells. Selection of the pumping system is also dependent on desirability of preferential recovery of free phase liquids and required discharge pressure. Wells and pumps may be designed to preferentially scavenge (recover) lighter than water phases from the groundwater. Specific pumping equipment selection requires evaluation of detailed recovery schemes.

Materials of Construction

When recovery systems are designed, consideration must be given to the effective life of the components, with respect to the chemical environment into which they will be installed. After detailed review of the operating environment, it may be determined that expenditures on exotic materials such as stainless steel, etc. may not extend the life of the recovery system. Contaminated groundwater may not be constant in quality with space and time and what is compatible at the initiation of the recovery system may not be compatible in the future.

The area where the greatest amount of improvement can be made is the compatibility of pumping equipment with the contaminated groundwater. Most recovery wells using standard off-the-shelf water well equipment result in frequent pump failure because of attack on the pumps by chemicals. Pump failures include chemical attack of the pump and motor casings, deterioration of the plastic and elastomer seals, fittings, and cable

sheaths. Low flow aquifers create situations where pump motors are run at temperatures in excess of manufacturer's design and experience subsequently shorter lives. Frequent cycling and pumping of abrasive materials also contribute to shortening of pump life. Pumps are being introduced into the market that will operate effectively in contaminated low flow environments. These pumps, many of which are operated with air, are expensive and still subject to failure during the life of the remediation project.

Well screens are also subject to failure as a result of chemical attack, corrosion, or mechanical plugging. When plugging occurs because of geo-chemical or biological reactions of the waste, the materials of construction have little effect. The plugging can be migration of sediment fines, chemical scales or biologic fouling.

Maintenance of Recovery System

In planning for a recovery system, consideration must be given to system maintenance. Recovery wells or trenches will not operate for the length of time required to clean up contaminated aquifers without maintenance during the life of the project. The wells and trenches must be designed and installed in such a manner so that "workovers" can be performed.

Many recovery systems are designed today based upon the results of transmissivity values derived from pumping test/recovery test. Using these values, well spacing programs have been developed to insure overlapping cones of depression. However, in many contaminated aquifers the zone of saturation is thin. If the well is inefficient, water levels in the pumping wells may drop to a point where very reduced pumping rates are required. Although the water level in the well may be low, the water level in the aquifer will be higher and overlapping cones of depression may not be maintained.

Corrosion and scaling of water wells and oil wells have long been problems. These historical problems in uncontaminated areas are magnified many times when dealing with contaminated aquifers that are often unstable from both a geochemical and geologic standpoint. The effects of the contaminants on the gravel pack, and slots of the well screen are very unpredictable. Many recovery wells require extensive maintenance to keep screens open. Replacement of recovery wells at 4-year intervals

is not uncommon and clean-out operations at 6-month intervals. In terms of cost of operations, recovery well maintenance may be a large cost factor.

4.2.2 Subsurface Collection Drains and Trenches

Subsurface collection drains and trenches include several variations but all involve placing linear permeable collection devices in the subsurface which collect fluid which is then pumped out from sumps.

Subsurface collection drains include:

- Tile drains
- Pipe drains
- French drains

Utilization of drains involve placement of the drains to depths sufficient to intercept contaminated groundwater. The system must be capable of intercepting the entire thickness of the aquifer. Tile drains and pipe drains only intercept a thin section of a saturated zone.

Difficulty of construction of french drains is a function of the following:

- Thickness of the aquifer
- Head within the aquifer
- Depth of the aquifer
- Trench stability problems resulting from the above

French drains or trenches may be potentially applicable for intercepting lighter than water phases present on the groundwater at some locations. For this purpose, the drain or trench would not need to penetrate the entire aquifer. The drain or trench would involve the following:

- Excavation of a trench on the downgradient perimeter of the floating phase layer to a depth of at least a few feet below the floating phase layer, and

- Placement of a synthetic liner on the downgradient side

If the trench were to be completed as a french drain, the following steps would be necessary:

- Placement of a perforated collection pipe in the trench
- Backfilling with sand/gravel to above the top of water
- Clay cap over the surface
- Installation of a sump or sumps containing a pumping system
- Means of handling and disposing pumped groundwater and excavated soil

4.3 GROUNDWATER REMEDIATION-TREATMENT

Treatment systems for recovered contaminants are typically the same systems that are in use for treating various waste streams from industrial facilities. For example, air stripping has been used conventionally for many years in the treatment of industrial effluent. This technology is now being used to treat groundwater contaminated with fuels. The use of activated carbon for aquifer restoration programs is widespread, especially for treating water to meet drinking water standards. Most treatment applications are specific to the type of contaminant in the recovered water. Treatment technology includes biological treatment for organic wastes, chemical oxidation for organics that do not respond to biological treatment, gas stripping for removal of volatile materials.

4.3.1 Air Stripping

Air stripping has conventionally been used in the treatment of industrial effluents. Within the last 10 years the technology has been used to treat contaminated groundwater, especially those groundwaters contaminated with fuels. The limiting factor is the organic carbon emissions which may be regulated. The technology is relatively simple and generally has low maintenance requirements. Air stripping is a contaminant removal technique based on concentration differentials between a liquid phase and a contacting gas phase. As air is contacted with a contaminated water streams in a

stripping tower, the concentration differential drives the organic contaminant from the liquid to the gas phase.

Air stripping is most applicable to compounds of a volatile nature with relatively low solubility in water. Chlorinated organics such as trichloroethylene, 1,1,1 trichloromethane and aromatic compounds such as benzene and toluene are good examples. The overall applicability of the technology can be expanded to compounds with lower Henry's law constants by preheating the water prior to its entering the stripping column.

Air stripping is effective in removing the aromatic gasoline components from groundwater event at normal groundwater temperature of 50°F. However, as would be expected, air stripping is ineffective in removing more soluble components of gasoline such as tert-butyl alcohol.

The major advantage of air stripping is its low overall treatment costs. Both capital and operating costs requirements are low compared to most other technologies. In many cases, however, air emission standards will require that air stripping be used in conjunction with a vapor-phase adsorption unit, significantly affecting the cost-effectiveness of the technology.

4.3.2 Carbon Adsorption

The use of activated carbon adsorption for aquifer restoration programs is widespread. Several literature sources indicate the ability to achieve exceptionally good effluent quality, and the EPA has endorsed it as the preferred treatment method for meeting drinking water standards. Three basic ways in which carbon can be used are:

- Throwaway carbon basis
- Thermal regeneration basis
- Nondestructive regeneration basis

Throwaway Carbon

One way to consistently ensure good effluent quality is to use activated carbon adsorption on a once-through carbon basis. Virgin carbon is capable of removing a broad range of organic contaminants to low parts per billion levels. A once-through carbon adsorption system is easy to operate, requiring a minimum of operation attention, and the capital cost requirements are relatively low.

Unfortunately, carbon treatment costs associated with once-through carbon adsorption systems are very high. The large treatment volumes and/or high concentrations usually associated with remedial programs results in a high carbon consumption rate. In addition, hazardous substances loaded onto activated carbon make the carbon a hazardous substance, requiring disposal in an approved hazardous waste facility.

Thermal Regeneration

The most common regeneration technique for activated carbon is thermal oxidation, usually accomplished in a multiple hearth, fluidized-bed or rotary-kiln furnace. A thermal regeneration unit can be built at the treatment site, but the level of carbon consumption associated with most remedial programs usually makes it more economical to utilize a thermal regeneration service.

Nondestructive Regeneration

There are two ways that granular activated carbon would be nondestructively regenerated at the Cedar Site.

- Using steam for volatile organics
- Using a solvent for a wider variety of organics

Steam has long been used to desorb volatile organics from vapor-phase adsorbers. Application of steam regeneration of activated carbon to wastewater treatment is an extension of this technology. After the lead carbon bed has been loaded in the usual manner, regeneration is accomplished by passing steam through the bed to a condenser.

The waste-organic condensate is then either decanted (for water immiscible solvents) or forwarded to a distillation step for recovery (for water miscible solvents).

Solvent regeneration of adsorbent involves the use of a solvent phase to desorb the organic chemicals from the adsorbent. The solvent is then removed (as in conventional solvent vapor recovery systems) by steam. The only requirement is that the organics to be removed be soluble in a common solvent. Solvents such as methanol, acetone, benzene, and methylene chloride have been used.

Regeneration is accomplished by contacting the spent carbon bed with the solvent found to be most effective. The solvent regenerate is distilled to recover solvent, leaving an organic concentrate suitable for recovery or incineration. (When a solvent already employed in the process is used to regenerate, added equipment for distilling the solvent may not be needed). The carbon, now saturated with solvent, is restored to adsorptive capacity by steaming off the solvent. The steam plus solvent vapors are condensed and separated. With solvent regeneration, the cycle of adsorption - desorption can be repeated many times before the carbon has to be replaced. Typical designs call for carbon replacement after 100 cycles.

4.3.3 Synthetic Polymer Adsorption Process

Adsorption systems consist of columns loaded with synthetic polymer adsorbents. Flow can either be down (fixed bed operation) or up (expanded bed operation). Loading rates are typically within the range of 2 to 8 US gal/min per ft² of bed cross section. The columns can be arranged in series or parallel, depending on the requirements.

The design of adsorption systems requires a knowledge of the equilibrium capacity (isotherm) of the adsorbent for the solutes to be removed and the overall rate of adsorption, factors normally determined by laboratory techniques. Column performance data at the temperature and pH of the system are generally required in order to obtain breakthrough curves to enable design for a specific effluent quality.

4.3.4 Biological Treatment

Biological waste treatment is a generic term applied to a variety of processes that utilize active microorganisms to convert wastewater or contaminant constituents to more stable forms. As the name implies, biological treatment is applicable only to those materials that are biodegradable. While certain inorganic chemicals (e.g., ammonia, reduced sulfur compounds, etc.) are recognized to be amenable to biodegradation, the technique is most commonly utilized to achieve the stabilization of organic matter. Biological treatment processes essentially simulate the biological reactions that would occur in the environment. However, since biological processes generally employ high concentrations of active microorganisms, under controlled conditions, the decomposition rates of degradable materials are vastly accelerated.

Biological oxidation uses active microorganisms to biodegrade organics to acceptable forms. The two major forms of biological treatment are aerobic, which produced CO_2 and H_2O and anaerobic, which produces CO_2 and CH_4 . Biological treatment is getting increased attention as a remedial alternative because of its potential for in situ treatment. Bioreclamation is basically just the use of indigenous soil bacteria to degrade organic contaminants. Nutrients, such as oxygen, and specific biological cultures can be added to enhance the degradation.

Bioreclamation (In situ Biological Treatment)

In situ bioreclamation is a method for remediating groundwater aquifers contaminated with hydrocarbons through the addition of nutrients and oxygen into the subsurface. The results in enhanced growth and activity of naturally occurring bacterial that use the organics as source of carbon and energy. Since most contaminated soils do not contain the optimum concentrations of all the necessary elements for bacterial growth, natural biodegradation, though present is not rapid enough to cleanse aquifers of gross amounts of contaminants. The enhanced bioreclamation process provide the oxygen, nitrogen, phosphorus and trace minerals needed to increase the natural biodegradation process.

There are a number of site specific factors which can impact enhanced bioremediation by altering the capacity of the indigenous microorganisms to grow and degrade the

contaminant. In general, microbial degradation of contaminants in the subsurface is controlled by the same factors that control these processes in surface waters and biological treatment facilities which include but are not limited to: microbial viability, nutrient availability and specific contaminant chemistry. These variables must be assessed and understood for each in situ bioreclamation project before an effective remediation strategy can be developed and implemented.

The basic principles involved in the assessment and design of an in situ bioreclamation project differentiate in-situ bioreclamation from surface biological treatment.

Above Surface Bioreactors

The major process equipment in biological treatment is basically a reactor to provide contact between the contaminated groundwater and the microorganisms, a solids-liquid separation device (such as a settling tank), sludge recycle pumps, and monitoring and control devices. Equipment for pH control and/or nutrient addition may also be required. Highly concentrated or variable waste loads may necessitate the use of an equalization basin before treatment. Finally, solids handling devices for final sludge treatment and disposal may be necessary. Descriptions of other variant schemes are given in the following paragraphs.

Aerobic Biological Treatment Systems may be subdivided into suspended growth and attached growth processes. Suspended growth processes utilize mixing mechanisms to suspend biological solids in a mixed liquor. Attached growth processes involve the contact of contaminants with biological films which are attached to a support medium.

The conventional activated sludge process is the most common example of an aerobic suspended growth process and consists of the following steps:

- Primary sedimentation to remove settleable organic and inorganic solids
- Aeration of a mixture of contaminated groundwater and a biologically active sludge

- Separation of the biological sludge from its associated treated liquor by sedimentation
- Return of settled biological sludge to be admixed with the raw wastes

Activated sludge processes can be classified according to the design process loading factor, or food-to-microorganism (F/M) ratio, which is commonly expressed as the rate of organic loading per unit weight of biomass (kg BOD/day/kg MLVSS). High rate processes are commonly operated at an F/M of 0.5 or greater, while "conventional" activated sludge systems are normally designed for an F/M in the range of 0.2 to 0.5. Extended aeration processes, with organic loading rates less than 0.2, provide longer detention times than conventional systems and achieve higher removals of organic matter and greater destruction of bio-solids through endogenous respiration. Such systems thus minimize the amount of sludge requiring disposal. System selection often involves an economic balance between the relative costs of increased aeration tankage and solids handling facilities.

In fixed-film biological treatment process, the biomass that affects degradation of contaminant components grown in the surface of a supporting medium. Historically, the most commonly applied aerobic fixed-film process has been the trickling filter. In its simplest form, the trickling filter is comprised of a cylindrical tank, filled with graded rock media. Recovered contaminated groundwater is applied the surface via a series of rotating distributor arms, allowed to pass through the bed, and collected at the bottom. Oxygen transfer and biodecomposition are achieved by diffusion through the slime layer that grows on the media. Several process modifications have been applied to trickling filters, including multistage designs, recycle, and forced-draft aeration. Most modern trickling filters utilize plastic media designed to promote water flow over a large surface area while *maintaining* a high void ratio for adequate oxygen transfer and alleviation of plugging problems. The principal advantages of trickling filters, in comparison to suspended growth processes, have been operational simplicity and low cost. However, since trickling filters can seldom achieve the increasingly more restrictive discharge limitations, few systems have been designed in recent years.

The rotating biological contactor (RBC) is an attached growth system consisting of a series of large diameter discs that are mounted on a horizontal shaft and slowly rotated

in a tank. Approximately 35 to 40 percent of each disc is immersed in the contaminated water to be treated. The organisms present in the groundwater adhere to the discs, eventually forming aerobic biological layers. During operation, the discs rotate and pick up a thin film of contaminated water from which the organisms remove organic materials and oxygen. In comparison to suspended growth systems (such as activated sludge), the RBC System generally entails a higher capital cost, but requires lower operating costs

The historical application of anaerobic processes has been primarily for digestion of primary and water activated sludges in industrial waste treatment. More recently, anaerobic processes have been seriously reconsidered as an economically attractive alternative to aerobic processes, particularly for pretreatment of higher strength industrial wastewaters, severely contaminated groundwater and contaminated solid media. Anaerobic processes require no oxygen, thereby eliminating the capital and operating costs of oxygen transfer equipment. Moreover, methane, as a by-product of the biological reaction, may be recovered for use as a fuel. Both suspended growth and fixed film anaerobic processes have been considered for treating contaminants.

The anaerobic contact process is a suspended growth anaerobic process. The process may be operated as a two-stage system, involving two anaerobic digesters in series. The contaminated water is fed to a high rate digester, and the sludge from this digester is pumped to a second-stage digester. The second-stage digester operates as a settling basin to permit the removal of microorganisms for the water. The biological organisms, as in the activated sludge process, are returned to the first-stage digester along with the raw waste. A more recent variant of the anaerobic contact process employs a single-stage digester, followed by a proprietary solids-liquid separation device, from which solids are returned to the reactor.

Applicability

Biological treatment has been widely used in the treatment of aqueous organic wastes and contaminants but has fundamental limitations. The biodegradability of organic compounds has been shown to vary widely among different chemical structures. Many factors make it difficult to determine the biodegradability of a compound based solely

on its molecular structure. These factors include the size and solubility of the molecule, the presence of more than one functional group in the molecule, and isomerism. Chemical or biochemical changes may occur in the compound so that its capacity for biological oxidation is different than for the original compound. Also, the type of biological organisms, the environmental conditions, and the effects of acclimatization may determine whether a specific compound is biodegradable.

In general, biological processes are applicable to the treatment of soluble, degradable organics in the concentration range of 0.01 to 1 percent. Removal efficiencies can vary from 50 to 99+ percent (BOD or COD), depending on the process configuration, loading factor, and the nature and distribution of organic material present in contaminated groundwater.

An example of using both chemical and biological oxidation involved treatment of a chemical spill with alkaline hydrogen peroxide. This chemical oxidation process was successful in reducing the spill concentrations to a level where biological oxidation could be used. This biological process made use of a portable aeration tank, a spray system and railroad ballast. Liquid was pumped from a sump dug next to the ballast, passed through the aeration tank, and sprayed back onto the ballast. The system was inoculated with a specially cultured microorganism that would degrade the spill. The ballast, being composed of coarse rock, supported the growth of the biological medium in a manner similar to a trickling filter. Nutrients were added to the systems as needed. After one month, the system successfully reduced the contaminant concentration from several hundred parts per million to less than 1 ppm.

4.3.5 Chemical Oxidation

Chemical oxidation is used to chemically modify waste streams either by completely oxidizing the organics to CO_2 and H_2O or by partial oxidation of the organics in order to detoxify them. These waste streams are often aqueous wastes that cannot be handled directly by biological oxidation (either because of organic strength or bioinhibitory characteristics) or incineration (because the organic concentration is too low or there is excessive corrosion caused by the presence of inorganic salts or halogens). Oxidation

is also used to purify aqueous streams (such as waste sodium chloride brines) to permit recycle.

Most of the chemical oxidation processes are based on one of two oxidizing -- agents chlorine or oxygen. Chlorine is generally not used for remediation because of the potential to create toxic byproducts. Many oxidation processes have been developed to modify the ability of these oxidizing agents to accomplish specific goals. These modifications usually seek to adjust the stoichiometry and/or kinetics of the chemical reactions.

Because of the varying optimum conditions for the effluent reactions, no one chemical oxidation process can be considered. The ones that come closest to being universally applicable (catalyzed and uncatalyzed wet oxidation) are the most expensive in terms of capital and operating costs. These processes are usually reserved for the tougher oxidation problems because the easier problems can be handled by the cheaper processes.

Selection of a process is usually based on process economics, which in turn depend on the contaminated groundwater volume, reaction stoichiometry, and kinetics. Considerations of the completeness of the oxidation and the formation of by-products are becoming more and more important as more data on trace levels of materials are developed.

4.3.6 Volatilization

Volatilization is defined as a process where the components of a liquid mixture are separated by virtue of the differences in volatility of the components into a liquid-phase product and a gas or vapor-phase product. There are as many different types or categories of volatilization as there are mixtures to be separated. In general, volatilization can be divided into four major categories: fractional distillation, steam stripping, evaporation, and inert gas stripping.

Fractional Distillation

Distillation is a separation technique applicable to both aqueous-organic liquid mixtures depending on the relative volatilities of the components and the desired separation. Unless the feed components of a distillation have large differences in volatility, a single vaporization and condensation step will not yield products very different from the feed. To produce a degree of separation by distillation, a number of successive vaporization and condensation operations are usually required. This is accomplished by causing the boiling liquid and a saturated vapor to contact each other counter-currently in a distillation column. Countercurrent contacting of the gas and liquid streams in a distillation tower is achieved by causing either the gas to be dispersed in the liquid or the liquid to be dispersed in a continuous gas phase.

Distillation is applicable to the separation of components from virtually any liquid mixture, including aqueous-organic and organic-organic liquids. It is also an integral part of many contaminant treatment and/or recovery processes such as carbon adsorption and solvent extraction. Depending on the nature of the separations required, distillation is a practical and very widely used separation technique.

Steam Stripping

Steam stripping is a special case of distillation which is directly applicable to removing volatile organic and/or dissolved gases from contaminated groundwater.

Ordinarily, heat is applied at the base of a distillation tower by means of a heat exchanger (boiler). When an aqueous solution is to be fractionated to give the nonaqueous solute as the distillate (overhead vapor product), and the water is removed as residue (bottom product), the heat can be provided by using open steam at the bottom of the tower. The distillate is a mixture of volatile solute and steam. For water-immiscible organics, phase separation yields an organic distillate.

The design and operation of a steam stripper for removing dissolved impurities from water is primarily dependent on relative volatility, just like other distillations. The relative volatility establishes the minimum boilup that can be used to remove the

component. The number of theoretical stages required in steam stripper can be calculated from the relative volatility, the boilup, and the fraction of the impurity to be removed. The relative volatility ($a_{1,2}$) of the ration of vapor to liquid composition for the two components under consideration is:

$$a_{1,2} = \frac{Y_1/X_1}{Y_2/X_2}$$

where:

Y = mole fraction in a vapor
X = mole fraction in a liquid

In the case of steam stripping, the first component is the impurity and the second is water. For a heterogeneous azeotrope involving water, the aqueous phase is saturated with the organic solute at the azeotrope temperatures. The azeotrope composition reported is the vapor phase composition. The relative volatility of the solute to water in a steam stripper is the ratio of the composition in the azeotrope vapor to the compositions in the saturated aqueous phase at the azeotrope temperature.

The preferred application of steam stripping is the removal of organic compounds or solvents which are contained in contaminated groundwater at dilute concentrations. If the relative volatility of an impurity to water in a steam stripper is greater than 4.0, the steam stripping may be an economically viable alternative for aquifer cleanup. If it is less than 4.0, extraction or carbon adsorption may be more economically attractive.

Gas Stripping

Volatile materials can be removed from a solution by passing a gas such as air or nitrogen through the mixture. The volatile component or components transfer from the liquid phase to the vapor phase. This can be accomplished stagewise in a column similar to steam stripping. A gas stripping system normally requires that the gas from the top of the column be treated in some manner to remove the stripped material before it is discharged to the atmosphere or sent to an existing flare or incinerator for

destruction. In the common case of air or nitrogen stripping of organics from water, the organics are removed from the gas by carbon adsorption.

The principal applications of air or inert gas stripping would be the same as that for steam stripping -- removal of volatile components from contaminated water. Gas stripping might be preferred over steam stripping when the contaminants to be removed are very volatile and a column is not required. Capital and carbon regeneration costs for gas stripping are normally higher than the capital and steam costs required for steam stripping, depending on the flow and volatility of the contaminants. In many cases, the off gas (air) can be flared or sent to an incinerator, thereby eliminating the cost of gas treatment.

4.4 SOIL REMEDIATION-STABILIZATION AND CHEMICAL FIXATION

Fixation of toxic waste attempts to render it insoluble. The waste is immobilized in a normal earth environment to form a less leachable product. This can be accomplished by addition of chemicals, surfactants, or complexing agents.

The cost of chemical fixation is a function of the amount of additives, particularly proprietary polymers, that need to be added to bond or encapsulate the waste and the extent to which mechanical equipment is required to handle the processing.

In the event that soils are stabilized and chemically fixed, a containment system is constructed around the soil. In addition hydraulic control systems may be utilized in conjunction with the containment structure. Section 4.1 and 4.2 discuss the appropriate technologies.

4.4.1 Fly Ash and/or Kiln Dust

Samples of sludge can be mixed in various proportions with fly ash and kiln dust. Results must be acceptable for both structural strength and leaching characteristics. Organic compounds should be targeted as the difficult compound to immobilize.

4.4.2 Conventional Pozzolanic Treatment

Addition of large amounts of cement (perhaps 15 to 40 percent) will form a sample of adequate structural strength. Laboratory tests must be determined for leaching characteristics.

4.4.3 Proprietary Polymers

The Hazcon process uses cement and a proprietary additive called "Chloranan" to immobilize and encapsulate hazardous waste into a concrete-like mass. Cement based solidification involves the mixing of wastes directly with Portland Cement, a readily available construction material. However, Portland Cement alone is not effective in immobilizing organics. The Hazcon additive Chloranan acts to neutralize the inhibiting effect that organics normally have on the hydration of cement. The relatively high concentrations of organics will require more Chloranan to be added to the waste to allow the concrete to properly cure. The Hazcon process does not claim to fix organics, only to result in a solidified product with physical properties that inhibit mobility of the organics and additionally will support construction equipment.

Since the Hazcon process depends upon the cement to treat the waste, immobilization of the metal constituents can be expected because most multivalent cations are converted into insoluble hydroxides or carbonates at the pH of typical cement mixtures. However, mildly acidic leaching solutions as rain, will allow metal hydroxides and carbonates to leach out of solution. For this reason disposal should be in a facility with multiple liners and a leachate collection system.

Chem Fix is a silicate based process which uses proprietary formulas of siliceous materials, lime, cement and special setting agents to solidify, stabilize and chemically fix hazardous waste. Most silicate based processes employ a typical silicate material as fly-ash or other pozzolanic material as additives. Soluble silicates such as sodium silicate or potassium silicate can also be used. Additives can include selected emulsifiers, surfactants, and absorbent.

The IWT hazardous waste treatment technology is based on solidification, stabilization and chemical fixation. IWT employs three sets of functional chemical groups including cement matrix chemistry, free radical and ion attack chemistry, and organophilic linking mechanisms.

4.5 SOIL REMEDIATION - THERMAL TREATMENT

Onsite thermal treatment by fully pre-packaged ready to operate transportable modules are readily available and accepted by the technical and regulatory community. The acceptance has not spread to the neighborhood and environmental groups.

4.5.1 Incineration

Three types of modular incinerators have been considered:

- Rotary kiln
- Circulating bed combustion
- Infrared

Rotary Kiln

The rotary kiln incinerator is the most versatile. The feed systems and the kiln can handle a wide spectrum of waste materials. Solid feed is introduced by gravity into the rotary kiln combustion system which operates below atmospheric pressure in a closely controlled air supply mode.

The kiln ashes (soil) are cooled in a moisture controlled environment and conveyed to storage when they are sampled for verification of full treatment.

The kiln gases are incinerated in a secondary combustion chamber designed to handle large variations in gas composition and volumes and to avoid any operating problems which may be caused by entrainment of fine solids in the kiln gas.

The secondary combustion chamber gases are water quenched and then processed through a high efficiency air pollution control module capable of removing submicron particulate matter and acid gases. Treated gases are exhausted by a induced draft through a stack which includes an automated, computer controlled monitoring system.

There are many sizes of rotary kiln modular units available. Thermal capacity ranges from 10 million BTUs per hour to 60 million BTUs per hour. Mobilization costs can range upwards of 1 million dollars for the large incinerators that are designed to handle large quantities of wastes. The smaller incinerators cost less to mobilize but are more expensive to operate per unit of throughput.

Circulating Bed Combustion

Circulating bed combustion is an outgrowth of conventional fluidized bed incineration. However, the circulating bed operates with higher velocities than conventional fluid beds and it recirculates the fluidized material within the system returning solid, liquid, sludge, or gaseous waste streams. The advantage of this incinerator are similar to those of a conventional fluidized bed system with lower susceptibility to corrosion of the boiler, a less complicated scrubbing, close temperature control and dry solid waste recovery.

The circulating bed combustor incinerates hazardous wastes in the presence of an entrained bed of solids. Rather than maintaining a fixed fluidized bed, this process utilizes much higher gas velocities to entrain the solids in a combustion chamber. The high turbulence and resulting high heat-transfer efficiency allow the system to operate at much lower temperatures than are typically encountered in a hazardous waste incinerator. Solid wastes are added along with limestone in the solids return line. Liquid wastes are injected into the bottom of the unit. Combustion occurs at 1450°F to 1600°F and is attained at these relatively low temperatures because of the high degree of turbulence in the combustion chamber, and because of efficient heat transfer from the recirculating solids of the waste stream.

Entrained solids are removed from the combustion gases in an integral cyclone. The solids are returned to the combustion chamber through a nonmechanical seal and reentered the combustion chamber within about 50°F of their exit temperature.

Particulates (including ash) that are not removed by the cyclone remain entrained in the combustion gas. This gas passes through a heat recovery/filtration system prior to discharge to the atmosphere. In the steam generation mode, water is preheated by the combustion gas, and then flows through "water wall" tubes in the combustion chamber.

NO_x formation is minimized by the relatively low combustion temperatures, and by the addition of secondary combustion air at higher locations in the combustor. Because the circulating limestone absorbs halogens, phosphates, and sulfur, a scrubbing system may not be needed to remove acid gases.

The existing circulating combustion bed incinerators are large, mobilization cost will exceed 1 million dollars.

Infrared Incinerator

Infrared conveyor furnace combustion uses silicon carbide resistance heating elements to volatilize organics from conveyed solids, soils and sludges. The organic gases are then destroyed in a secondary chamber or afterburned.

The system consists of a waste preparation system, feed metering system, infrared primary chamber, supplemental propane-fired secondary chamber, exhaust gas scrubber, data acquisition and control systems, and heating element power centers, all mounted on transportable trailers. The compact, size of a typical unit allows for relatively quick and low cost mobilization.

Waste material is first processed in waste preparation equipment designed to reduce particle sizes to dimensions that can be handled by the incinerator. After leaving the waste preparation equipment, the feed is weighed. Waste material is then fed to a hopper mounted over the furnace conveyor belt. A feed chute on the hopper distributes the material across the width of the conveyor belt. The feed hopper screw speed is used in conjunction with the conveyor belt speed to control the feed rate and bed depth.

The incinerator conveyor, a tightly woven wire belt, moves the waste material through the insulated heating modules (primary unit) where it is brought to combustion

temperature by infrared heating elements. Rotating rakes gently stir the material to ensure adequate mixing and complete burnout. When the material (ash) reaches the discharge end of the furnace, it is cooled with a water spray. The material is then discharged by means of screw conveyors to an ash hopper.

Combustion air is supplied to the primary unit through a series of overtire air ports located at various points along the length of the chamber, and flows countercurrent to the conveyed waste.

Exhaust gases exit the primary chamber near the feed module to a secondary chamber (afterburner), where propane-fired burners are used to ignite any organics present in the exhaust stream, and burn them at a predetermined set-point temperature. Secondary air is supplied to the afterburner to insure adequate excess oxygen levels for complete combustion. Exhaust gases from the secondary chamber then pass through a scrubber type pollution control system (PCS) to the exhaust stack. The infrared unit is indeed portable and can be mobilized in less than one month.

4.5.2 Thermal Desorption

Incineration is often not considered favorably in a study of alternatives because of perceived high capital cost, high operating cost and high exposure to publicity in the permitting process. The thermal treatment proposed here involves indirect heating in a nitrogen atmosphere in a multipass screw flight dryer. This thermal treatment or thermal desorption may be more acceptable because:

- The capital requirement is moderate
- Operating cost is moderate
- It would not require a RCRA incinerator permit although it would require an air permit.
- There would be less tendency to volatilize heavy metals

A screw flight dryer is an indirect hollow-screw jacketed-trough thermal dryer for dewatered filter cake. The screw rotates, pushing the material down stream while a heat transfer fluid flows through the screw and jacket, drying the material. The vapors are removed by operating under pressure with an inert gas passed through to carry the

vapors away from the discharge end. The vapors are passed through a cyclone to remove entrained soil then to a cooler to condense organics. Non-condensed gas could be recycled to the inert gas stream with a purge stream to a flare or vent. The process is well defined but untried. In order to proceed along this route without risk, a pilot program should be run to determine rate of throughput, maintenance downtime due to fouling, and optimum operating temperatures. It would take an additional eight months to construct a commercially sized treatment unit if one is not now available.

4.6 SOIL REMEDIATION SOLVENT EXTRACTION

Resources Conservation Company (RCC) has a process they refer to as the B.E.S.T. process. They have constructed a modular unit and have successfully operated on oily sludges at a Superfund Site. The process takes advantage of the fact that triethyl amine (TEA) solvent and water are miscible at 50°F and undergo a phase separation at 120°F.

The basic steps in the process are:

- Extraction of oil and water from the solids with TEA at approximately 50°F
- Drying of the solids to remove residual TEA and water
- Heat exchange of the single phase effluent from the contractor to bring about TEA/water phase separation
- Distillation of the decanted water to reduce its TEA concentration
- Distillation of the decanted TEA/oil mixture to recover purified TEA for recycle and produce oil

4.7 SOIL REMEDIATION BIOLOGICAL DEGRADATION

Landfarming, which involves biological degradation, may be a viable alternative in the study of alternatives because of the large amount of land in the south plant and the time available to achieve degradation. Another option is to biologically degrade organic compounds to below action levels in a liquids solids contractor. A liquid solids contractor is an aerobic reactor that uses high speed mixers. The objective is not 100% degradation of organics but rather degradation of objectionable leachable compounds to safe action levels. The residuals would then be stabilized by conventional methods.

EPA's Region 10 has evaluated composting as an ex-situ solid phase biological treatment technology to degrade nitroaromatic and nitramine compounds in soils. Treatability studies at two National Priority List sites — the Umatilla Army Depot Activity site in Hermiston, Oregon and the U.S. Naval Submarine Base site in Bangor, Washington — demonstrate that composting is a treatment alternative to incineration for remediating these compounds.

Composting mixes natural organic amendments, such as manure, wood chips, alfalfa, vegetable processing wastes and cotton gin wastes with 30 to 70 percent contaminated soil and adds water to 50 percent of moisture holding capacity. The process utilizes native aerobic thermophilic microorganisms and requires no inoculation. Composting operates under mesophilic [30 to 35 degrees Centigrade (C)] and thermophilic (50 to 55 degrees C) conditions, with thermophilic conditions being optimum.

Composting residues will support the growth of vegetation after treatment, unlike incineration ash or soils treated by solidification/stabilization. The final volume increase in soil is approximately 50 to 100 percent, similar to stabilization/solidification technologies. Composting is suitable for soils and sludges. Composting does not appear to be particularly sensitive to soil type.

Some pilot effort would be required to optimize the method.

4.8 OFFSITE TREATMENT AND DISPOSAL

The offsite treatments available are incineration at a permitted RCRA incinerator with disposal of ash at a RCRA hazardous waste landfill or direct disposal at a RCRA hazardous waste landfill.